The WELDING ENGINEER

April 1934
Vol. XIX No. 4

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er Business and Technical Journal of the Welding Industry

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THE WELDING ENGINEER

LEADING ARTICLES IN THIS ISSUE

APRIL 1934

Vol. 19, No. 4

NRA MEMBER U.S. WE DO OUR PART

Stresses (Page 17)
Studying Stresses With the Aid of the Polariscope (Smith)

Plate Work (Pages 20 and 26)
Erecting a Gas-Holder (Bright)
Modernizing a Blast Furnace

Modern Train Design (Page 28)
Stream-Lined Train Opens New Era in Railroading

Editorial—(Page 15)

Annual Meeting of A. W. S.—(Page 19)

Welding Contractors Hold Convention—(Page 19)

Sprayed Aluminum Coating Reduces Heat Loss—(Page 24)

Pavement Rooter Welded From Scrap Materials (Archer)—(Page 25)

Flywheel Repair Requires Careful Preheating and Cooling—(Page 30)

Welding News in Pictures—(Page 31)

New Equipment—(Page 32)

Trade Literature—(Page 34)

Commercial News—(Page 34)

Notes From the Field—(Page 36)

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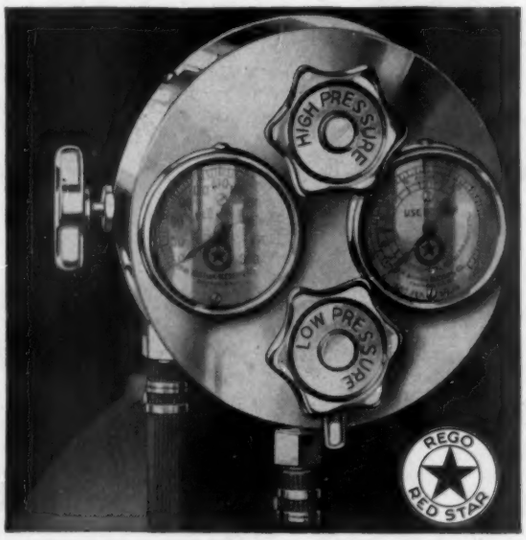

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INDEX TO ADVERTISERS

PAGE

A

Air Reduction Sales Co. 14
Aladdin Rod & Flux Mfg. Co. 40
American Brass Co., The 37
American Manganese Steel Co. 9
American Steel & Wire Co. 11
Anti-Borax Compound Co. 42
Arcos, Inc. 42

B

Bastian-Blessing Co. 6

C

Central Steel & Wire Co. ..... Inside Rear Cover
Churchward Engineering Co. 42
Commercial Acetylene Supply Co., Inc. 40

F

Federal Electric Co. 40
Fibre-Metal Products Co. 39

G

Gulf States Steel Co. 13

H

Handy & Harmon 16
Harnischfeger Corporation 7
Hobart Bros. 3

I

Ideal Face Shield Co., The 42
Illinois Steel Co. 10

L

Lincoln Electric Co., The ..... Rear Cover

M

Metal Bond Manufacturing Co. 42
Milburn Co., The Alexander 42

N

National Carbide Sales Corp. ..... Inside Rear Cover

P

Page Steel & Wire Co. 39

R

Revere Copper & Brass, Inc. ..... Inside Front Cover
Roebling, John A., Sons Co. 4

S

Smith & Sons, Inc., David H. 38
Stoody Co. 41

T

Torchweld Equipment Co. 40
Torit Mfg. Co. 42

U

Unimetal Co. 40

W

Westinghouse Electric & Mfg. Co. 8
Wilco Electric Welding Machine Co. 42
Wooldridge Aluminum Welding Products 40

Y

York Engineering & Supply Co. 41

· E D I T O R I A L ·

Playing Hide-and-Go-Seek With Specifications

● Whenever manufacturers of welded products come up against Government specifications barring welded equipment, no time should be lost in acquainting the Government Department issuing the bid with the advantages of welded construction, as regards economy, dependability, and maintenance. The recent experience of a manufacturer of welded steel furnaces is of interest in this connection. Early last summer this company received specifications from the Quartermaster Department for a large lot of furnaces. The specifications read: "Heaters, room, barrack type, cast iron, coal burning . . ." This company, together with a large manufacturer of welding equipment and supplies, immediately got busy to secure the Government's permission to bid on steel furnaces as well as on cast iron. As a result, a specification came out reading: "Heaters, room, barrack type, cast iron or boiler plate steel . . ." After obtaining an order for some welded furnaces, this company was surprised shortly thereafter to find this new specification: "Heaters, room, barrack type, cast iron or riveted sheet steel of heavy gauge . . ." Again the company used every means possible to have the specifications changed, and the following was the result: "Heaters, room, barrack type, cast iron, riveted sheet steel or welded construction . . ." The company has been assured by the Quartermaster General's Department that future specifications would include welded steel furnaces on a parity with riveted. So the incident was over, so far as the Quartermaster General's Department was concerned. ¶ But now it appeared as though another Department of the Government would have to be "educated," for word was received of specifications for cast-iron furnaces in garages being built for the CCC camps. It was learned that some, if not all, such specifications were prepared by the Engineering Corps, and were therefore outside the jurisdiction of the Quartermaster General. Efforts are being continued to get the Engineering Corps' specifications changed. ¶ Throughout all these negotiations to effect specifications allowing welded construction, the furnace manufacturer reports that the Government Departments involved showed every evidence of being friendly and fair. When the specification was changed from "boiler plate steel" to "riveted sheet steel of heavy gauge," thereby barring welding, though later the error was rectified, evidence indicates that the change was made inadvertently without any intention of eliminating welded construction. ¶ In the case of the welded furnaces sold under these specifications, the contracts went to the lowest bidder. If the specifications from the beginning had allowed welded construction, undoubtedly many more welded furnaces would have been sold at a saving to the Government. ¶ As Government agencies are made acquainted with the points of superiority of welded furnaces and other welded products, there is every reason to believe that specifications will be changed to allow welded construction. Education must go on until this goal is reached.

The Steel Erector Takes a Tip From the Tailor

● Since merchant tailors build ready-to-wear suits to fit average physiques, and no one seems to have the average physique, such suits require minor alterations when the customer purchases them. The customer may be knock-kneed, with a curved spine and a low left shoulder, but the merchant can give him what he wants in size, pattern and style; then with a few snips of the shears and application of needle and thread, a garment is produced that either fits him like a glove or hides his physical deformities, whichever is preferred. In either event, the customer enhances his appearance, and adds his bit to making us the best-dressed nation in the world. ¶ It is not such a far cry from tailoring with wool to tailoring with steel. Mark this, however, that it has been the custom among steel fabricators and erectors to work with such close dimensions that the pants and coat tailored in the shop are expected to fit the form without so much as changing a single stitch. This custom is handed down from a time when the fabricator employed bolts and rivets in making the clothes and, naturally, any alterations made in the field were very expensive. Pity the fabricator or erector who encounters such puzzling situations as those described in this issue in the story on the welding of uptakes and downcomers on a blast furnace. However, the erector who tries to fit a garment on a structure that is warped out of shape need not be any more nonplussed than the clothing merchant trying to fit a hunchback with a coat; even when built to specifications based on inaccurate blueprints, the tailored steel suit need not be discarded if it does not fit the structure. In the case cited of the blast furnace, the erector did exactly what the merchant would do: he used a gas cutting torch for shears and a welding electrode for needle and thread. The result was a first-class job, without leaks, and with very little additional cost and time spent in making alterations. It was the erector's first experience with welding and cutting on a job of this kind; but it won't be the last. From now on he will use the welding arc and the cutting torch wherever field alterations are required.

Sil-Fos... the Answer to Many Coppersmith's Problems

An Example

The copper coil illustrated was made for a milk or cream pasteurizer by the J. V. O'Brien Co., Cleveland, Ohio. Seven joints were SIL-FOS brazed in 2" coiled pipe. The entire unit was then tin-plated.

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[SIL-FOS can now be obtained from all distributing stations of the Air Reduction Sales Company in the United States, as well as from the many prominent supply houses who have carried it in the past.]

HANDY AND HARMAN 82 Fulton St., New York

The Welding Engineer

VOLUME 19 | APRIL, 1934 | NUMBER 4

Studying Structural Stresses With the Aid of the Polariscope

■ By E. W. P. SMITH
Consulting Engineer,
The Lincoln Electric Co.

THE efficient fabrication and use of any structure depends fundamentally upon the proper distribution of stresses in that structure. If there is a point at which stresses concentrate to a degree affecting the safety of the structure, then high strength or uniform stress distribution elsewhere in the structure goes for naught.

The point is, that for economic construction we must have uniform stress distribution; we must have stresses distributed in proportion to the loads carried. As applied to welding, this means that welded joints should be so designed that they tend to distribute stresses equally and to the best advantage.

As will be brought out in this article, it is entirely possible to design and make welds which are physically strong, with weld metal superior to the base metal in physical characteristics, but which very definitely weaken the joint. For example, a heavily reinforced weld may not be as strong as one with less reinforcement, owing to poor stress distribution brought about by an abrupt change in contour.

In the past, the only method for determining the best design for welds in many cases has been by trial and error. Engineering formulas help the designer only so far. Average values for stresses are not applicable where there is severe stress concentration.

It is the purpose of this article to explain a simple method for studying stress distribution as an aid to designing the most practical, efficient and economical welded joints.

Photoelasticity provides a method of stress analysis based on the effects of polarized light upon a stressed transparent model. When a transparent substance such as celluloid or bakelite is subjected to stress, the speed with which light passes through is in proportion to the stress at any given point. With polarized light (light in which the rays travel in one plane perpendicular to the direction of the beam) the locations of stress are brightly colored. Furthermore, the value

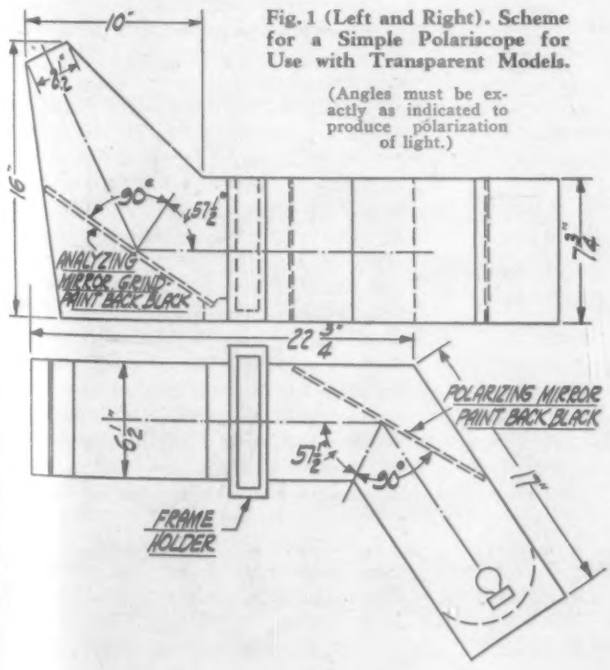


Fig. 1 (Left and Right). Scheme for a Simple Polariscope for Use with Transparent Models.

(Angles must be exactly as indicated to produce polarization of light.)

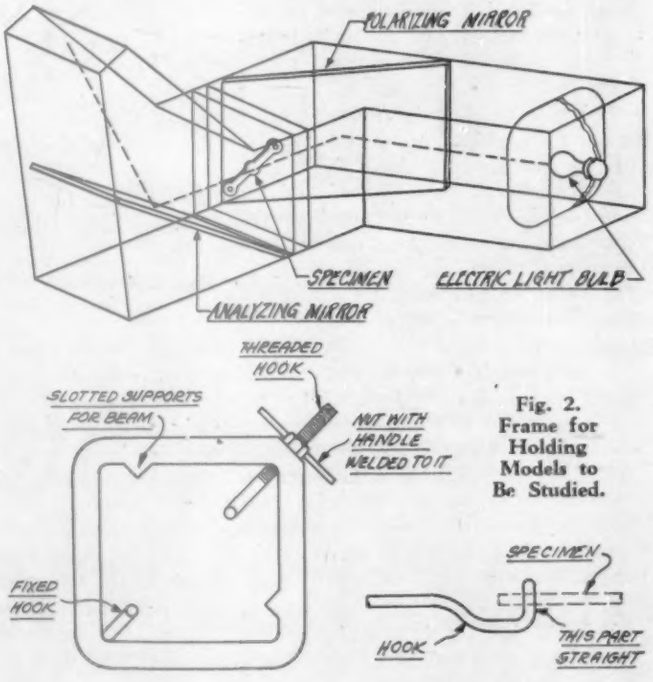


Fig. 2. Frame for Holding Models to Be Studied.

or extent of the stresses can be determined by the different colors and the various intensities. As each ray travels through the material, it is retarded in proportion to the stress present at that point, causing the material to appear colored.

If, therefore, we cut patterns from celluloid to represent sections of welded joints made in various ways, and make a simple device for exerting a pull on these samples, we need only some method of producing polarized light in order to study the stress concentrations.

There are many types of apparatus for studying photoelasticity. These are called polariscopes. They vary from large, complicated and expensive units to a simple, compact apparatus which can be constructed for a few dollars and which can be carried about easily. Fig. 1 shows such equipment requiring only a few parts. It can be made easily and quickly.

Frame for Testing Tension and Bending Specimens

In addition to the polariscope itself, models and a suitable frame for holding these models are needed. It is advisable to make a frame which is suitable for testing both tension and bending specimens. Inasmuch as it is desirable to have the specimen or model at an angle of 45° as shown in the drawing, a study of the conditions or methods of loading the model is helpful.

Two hooks are placed in the opposite corners of the frame (Fig. 2), and so formed as to receive the model and permit its easy removal. They should be of a type which will assure that the model is held straight and the center of pull exactly in line with the center of the model. This makes it easy to insert and remove the model, avoids bending, and assures proper tension. One of the hooks is stationary, while the other is fitted with a screw or lever arrangement so it may be moved and thus put the desired tension stress on the model.

Lever arrangements have the advantage that weights may be used and the actual total tension on the specimen determined. The same thing can be done by putting an ordinary spring scale in series with the specimen, but this is not so conveniently done from a construction standpoint.

To make bending investigations of the simple beam type, it is necessary to provide two points of support and a load point. The load may be applied by direct loading from a rod, threaded and inserted in the corner of the frame, or the same thing may be accomplished by a saddle and the load applied as a pull or weight hung underneath the beam.

Fig. 2 illustrates a frame for tension and also for loading the beam by pulling on a saddle or a weight suspended underneath the beam. The frame may be made of any material, provided it is strong enough. Plywood makes a light, easily handled frame. Suitable washers for bearing surfaces must be provided.

Directions for Making Specimens for Testing

The specimens or models may be made of celluloid or bakelite. For the polariscope as shown in the drawings, a convenient thickness is 0.178 in. The material used *must be of uniform thickness.* Though this point is exceedingly important, the actual thickness is immaterial, provided the specimens are properly proportioned.

The specimen should be of uniform

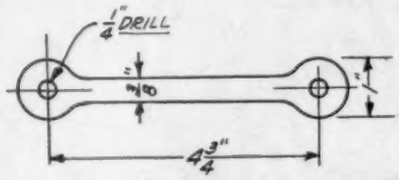


Fig. 3. Plain Specimen for Testing in Pure Tension.

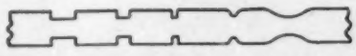


Fig. 4. Model Designed to Show the Effect of Abrupt Changes in Contour.

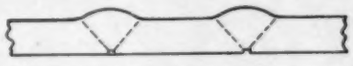


Fig. 5. Model for Comparing Stresses in Butt Welds Having Good and Poor Penetration.

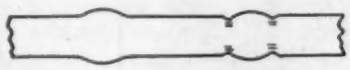


Fig. 6. A Double-V Butt Weld With Undercutting.

Fig. 7. Model to Represent Double-Butt-Strap Joint, for Comparing Filled Welds of Different Slopes.

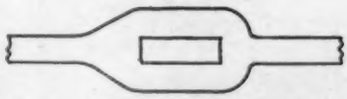


Fig. 8. Specimen to Show the Effects of a Heavily Reinforced Bead.

width, except where the model plan definitely calls for irregular shapes. The center line of the specimen should be aligned with the center lines of the holes for the hooks, unless the study requires unequal loading. This is important in order to avoid bending and consequent inaccurate or misleading results.

If a perfectly plain, even specimen such as that shown in Fig. 3, is put in the polariscope unstressed and the light turned on, there will be found a reflection of the piece in the analyzer. The image will be clear, but it will not be particularly or brilliantly illuminated.

As tension is applied, color will appear on the specimen. If celluloid is used, the first color noticed will be yellow. As the tension is increased, yellow will turn to orange, then red, then violet, blue and green. A still further increase in tension will bring forth yellow, which marks the beginning of the second series of colors. When tension is released on the model, the colors will appear in reverse order.

Interpreting the Color Fringes

Each of these colors may be said to represent a different stress. Greater stress is required to show red than is needed for yellow. Green indicates the greatest stress in a given series. Actual values may be obtained by measuring the pull or tension on the specimen by means of a scale, levers and weights; then, dividing by the cross-sectional area gives the stress per unit section. From this, the ratio of one stress to another may be obtained. (For example, green indicates a stress approximately three times that of yellow.) Also the actual value of the stress is known. It should be kept in mind that it is value of stress and not direction which is shown by the colors.

Most problems are concerned with the ratio of maximum to average stress. For example, if the average stress is 15,000 lb. per sq. in., the maximum may be 45,000 lb. While such high stresses are undesirable, in some cases dangerous, they can be materially reduced by proper design of the welded joint.

Reducing Maximum Stress by Changing the Contour

One way to reduce maximum stress is to avoid abrupt changes in contour. It is very easy to see just what happens when we have an interruption of the surface of a welded joint. Suppose we have a model such as that shown in Fig. 4, with a series of slots of the same depth but varying width. If this model is subjected to load in the polariscope, it will be seen that the stress is not uniformly distributed. The more abrupt the interruption of the surface, the greater is the stress accumulation. In other words, a very fine crack will cause much greater stress concentration than a crack of the same depth but wider. The smooth-curve indentations indicate the effect of lessening the abruptness of the interruption.

This and similar tests offer visual proof of the statement that any interruption of the surface of a stressed member causes stress concentration, and the greater the abruptness the greater the concentration.

By making up specimens with two or more shapes on the same model, we are able to compare quickly the efficiencies of various types of joints. The comparison will be accurate because both joints

are subjected to exactly the same load. The shielded-arc electrode gives weld metal equal to and in fact superior to the plate, so if a model cross-section of a welded joint is made of celluloid, the model joint being made of the same material throughout, it is equivalent to the welded joint.

We can make a comparison of a single-V joint properly made and one improperly made. Assume in one case that a backing-up strip was used and complete fusion obtained to the bottom of the V. In the other case fusion was not complete, as indicated by the nick. (See Fig. 5.) When loaded and observed in the polariscope, these specimens will show a very different concentration of stresses at the nick.

Beads of different heights and contours may be compared—always the abrupt change of contour will show points of less-uniform stress distribution.

The number and variety of experiments which can be carried on with the polariscope are almost unlimited. The apparatus is of valuable help to any designer in solving his problems. It has been found beneficial in instructing welding operators and in showing them just what happens when welds are improperly made. It is probably the most effective method ever designed for explaining visually what happens to a weld under load.

It is not the purpose of this article to discuss primarily the designing of joints or welded structures but rather to point out a method which will be of help in such work and to show how this simple device may be used in solving complicated problems.

Figs. 6, 7 and 8 show some interesting studies of various types of joints. Fig. 6 compares a good double-V joint with one in which there is undercutting.

Effect of Fillet-Weld Design on Stress Concentration

Fig. 7 is a model of a double-butt-strap joint. While common practice often calls for the faces of a butt-strap weld to be at a 45°-45° angle, the polariscope shows that a 30°-60° angle for butt-strap welds results in much better stress distribution when the load is applied.

Fig. 8 is a specimen showing a comparison between a heavily reinforced bead and a good bead on a double-butt-strap joint. Where certain types of electrodes are used it is almost impossible to get other than a highly reinforced bead. Shielded-arc electrodes give less reinforcement and consequently provide beads which have a more uniform stress distribution. This can be seen very readily if a specimen such as that in Fig. 8 is loaded.

Studies may be made of lap joints which involve not only consideration of the shape of the weld bead but also the shape of the entire joint. The effect of putting holes in plates, such as for bolting or riveting, may be studied. Odd-shaped models involving complicated design problems can be investigated with the polariscope as readily as the examples cited.

With the aid of the polariscope engineers can make a duplicate of celluloid or bakelite of practically any unit under consideration and, by observing the color changes caused by the stress, the locations of maximum stress can be quickly determined. With this information it is frequently a simple matter to redesign the member so that the stresses may be distributed more evenly.

Annual A. W. S. Meeting on April 26th

Report on the annual election of officers and a meeting of the American Bureau of Welding and of the Structural Steel Welding Committee, will feature the 15th annual meeting of the American Welding Society, to be held on the fifth floor of the Engineering Societies Building, at 33 West 39th St., New York, on Thursday, April 26th.

A business session, presided over by President F. P. McKibben, will be held at 10 a. m., at which the president will report on Society activities and the tellers will make their report on the election of officers for the ensuing year.

At 2 p. m. will be held a meeting of the American Bureau of Welding, presided over by C. A. Adams, director, the program including reports of committees and election of officers. A discussion will also be held on proposed new research work.

The meeting of the Structural Steel Welding Committee also will be held in the afternoon and will be presided over by the committee chairman, L. S. Moisseiff. The committee will consider a proposed program of investigation on seat-angle and beam connections, to be presented by Professor Inge Lyse, of Lehigh University, and his assistant.

At 6:30 o'clock, a meeting of the board of directors will be held in Parlor E of the Hotel New Yorker, followed by the annual dinner of the Society.

Stuart Plumley Joins Staff of Chicago School

Stuart Plumley, until recently chief engineer of the Smith Welding Equipment Co., of Minneapolis, Minn., and author of a widely known handbook on oxyacetylene welding and cutting, has been appointed instructor of welding in the Washburn Continuation School, 14th and Union Ave., Chicago, Ill. These welding courses are being given for the benefit of steamfitter apprentices, under the auspices of the Chicago Master Steamfitters Association and the Steamfitters Protective Association.

Welding Contractors Hold Convention

Election of officers and consideration of the welding code occupied the attention of The National Association of Welding Contractors, Inc., at a 3-day convention held at the Statler Hotel in Detroit, Mich., April 6th to 8th. The convention was in the nature of an emergency call to discuss and correct conditions and misunderstandings which had arisen since the meeting held in Chicago some months ago.

The attendance, while not large, was representative of the welding shop and contracting business between New England and the Atlantic seaboard on the east to Iowa on the west, there being no representatives present from the far west and southwest.

The first day was devoted to an open discussion of the Code of Fair Competition drawn up by the Association and now in the hands of the NRA, awaiting approval and the President's signature.

On the following day occurred the election of officers. A Nominating Committee, consisting of Mr. Gibbs, of Des Moines, Mr. Pressler, of Chicago, and Mr. Hamburg, of Detroit, was appointed by Chairman Dale George, after which a motion was made and passed that the existing officers terminate their offices as of Jan. 1, 1934.

The new directors duly elected were as follows: Dale S. George, Akron, Ohio; Walter J. Thomas, Detroit, Mich.; E. S. Fisher, Cincinnati, Ohio; Henry Malek, Cedar Rapids, Iowa; Edmund E. Pressler, Chicago, Ill.; Howard W. Taylor, Danbury, Conn.; and George R. Fisher, Philadelphia, Pa. Mr. Fisher's election is tentative, pending action by the Philadelphia Association of Welding Contractors in joining the National Association of Welding Contractors. Vacancies in the board of directors will allow a later addition of one director from the West Coast and one from Texas.

Dale George was given a vote of confidence in the form of unanimously re-electing him president. Walter J. Thomas, of Detroit, was unanimously elected vice-president.

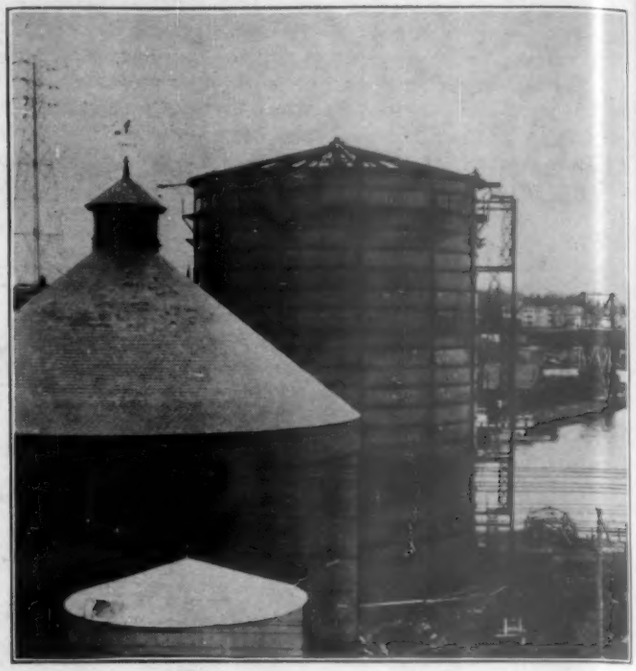
An amendment to the by-laws and constitution was adopted, vesting in the president the duties of managing director, secretary and treasurer and requiring the president to be bonded and to mail monthly to the directors a statement of finances and business of the Association.

The third day was devoted largely to a rediscussion of previous business and a review for late-comers. A banquet was held in the Hotel Statler on Saturday evening.

Preliminary studies, including detailed step-by-step procedure for welding, were of aid in expediting the field work in connection with

Erecting an All-Welded Gas-Holder

■ By T. F. BRIGHT
Consulting Engineer



IN THE design and construction of an all-welded structure or machine, preliminary work and study are very important in setting up the detailed procedure or routine to be followed in the actual fabrication or erection of the finished product. The importance of these preliminary activities is often overlooked by executives and engineers.

The author has been extremely fortunate in being brought into close contact with the design of a waterless gas-holder unusual in size and having the distinction of being the first of its type to be fabricated by welding. The successful erection of this structure was undoubtedly due, to a large extent, to the detailed step-by-step procedure worked out prior to fabrication. The writer desires to pass on to the readers of *The Welding Engineer* this detailed procedure to impress upon them the importance of such study, with the hope that it will lead to an increased number of welded structures being studied prior to fabrication and erection.

The structure referred to is a 200,000-cu. ft. waterless gas-holder, fabricated by the Bartlett Hayward Co., of Baltimore, Md., for the Cumberland County Power & Light Co. at its gas plant in Biddeford, Me.

In order that the welding procedure will be better understood, a detailed description of this structure will be given.

The holder consists of a cylindrical shell, 60 ft. in diameter by 82 ft. 6 in. in height, stiffened by 12 vertical columns equally spaced about the circumference and by horizontal stiffener galleries encircling the cylinder, as shown in the accompanying illustrations and drawings.

Within the shell is a freely moving or floating piston, and at the top is a roof, provided with ventilating features, to protect the inside.

The foundation consists of a concrete pad, 6 in. in thickness, supported at the outer circumference by a 2-ft. ring of reinforced concrete, approximately 4 ft. deep. In this outer ring of concrete, under each of the twelve columns, are three piles. At the center, which is also supported by three piles, is a pad, 5 ft. square and 2 ft. 3 in. deep, located directly beneath the center guide post. The purpose of the piling is to anchor the holder rather than to support it.

Welding the Bottom and the Shell

The design of this waterless holder is that of an all-welded, circular shell instead of the conventional polygonal, riveted type. No. 10 gage steel plates form the bottom and are ordered to size and shipped direct to the erection site from the mill; these, as the procedure states, are assembled on a 1-in. cushion of oiled sand and are welded in place. The outer edges are cut to a circle in the field after welding. The shell is constructed of 22 courses, each course being made up of 12 plates, each 3 ft. 9 in. wide and 15 ft. 8 in. long, the length being such that all vertical welds are made at the columns. The ends of the plates are butt welded together and welded to the inside face of the column flange in the same operation, and are then fillet welded on the outside to the edge of the column flange.

The shell plates are flanged 2 in. at the bottom and 3½ in. at the top to provide a down-hand horizontal weld on the outside of the shell. This also allows for a light, continuous horizontal weld on the inside, thereby providing a recess large enough to store a quantity of tar in the upward motion of the piston, sufficient to lubricate it in its down movement. The bottom course of the shell sheets are 3/16 in. and the remainder are 9-gage.

All vertical columns are 19.8-lb. 5-in. H-beams, anchored at their bases by anchor bolts securely set in the foundation. The tops of the columns support the outer ends of the roof-supporting beams.

At the top of the 7th, 14th and 22nd courses is a gallery, utilized not only for the purpose of a walkway, but also as a stiffener, since it is welded solidly to the shell flanges. The top gallery also holds the outer edge of the roof.

The piston is constructed of a number of radial Fink trusses, to the bottom chords of which are welded the piston plates. A tar cup, identical in general design to the M. A. N. idea, is located at the outer circumference of the piston, while at the center, around the center guide post and suspended from the bottom chords of the trusses, is placed an 18-ft.-diameter tar reservoir. This reservoir is connected to the outer tar cup by two 6-in. pipes. Sufficient weight is added to the piston by the tar stored in the reservoir to replace the blocks that were used on the old type to obtain the required pressure.

A vertical tubular steel post, 24 in. in diameter, is located at the axis of the cylinder and serves as a guide for the above-described piston. This post, passing through the center of the trussed piston, extends from the holder bottom to the summit of the roof, where it serves to support the ends of the radial roof girders, which, combined with the purlins, jack rafters and plating, provide sufficient stiffness to securely hold the top of this center post in position. This

design not only provides for the vertical guiding of the piston but also permits free circular motion caused by temperature changes.

Around the center guide post are two heavy machined and flanged circular sleeves equipped with gusset plates, to which are welded the upper and lower ends of the trusses.

A drawing of a half sectional view, reproduced herewith, discloses the various adjuncts, such as the center sealing and lubricating devices, liquid seal cups, rubbing bars, guides, catch basin, dam, overflow weir, blowoff and ventilator. These details will be passed over, since a complete description is not required to understand the detailed step-by-step outline for erection and welding, prepared in advance for the erector.

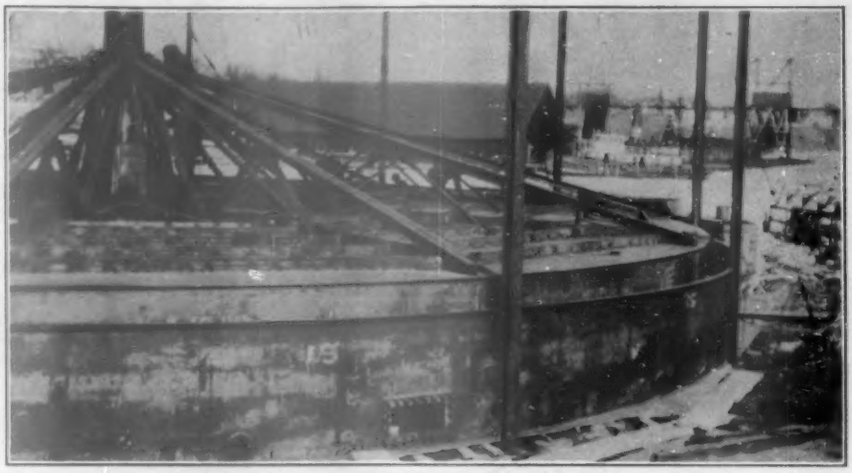
First will be presented the general instructions for the fabrication, which will be followed by the detailed instructions, including sketches.

General Instructions for Fabrication

1. The center pipe base is set upon the foundation, leveled and bolted down. The level is to be checked carefully after the foundation bolts are tightened down.

Center Guide Post and Piston Trusses in Place.

2. A layer of oiled sand, 1 in. thick, is spread evenly over the entire foundation. The outer and inner bottom plates are then assembled, these lying flat on the top of this cushion and being tack welded with lap joints. The continuous seam welding on the inner bottom plates is then performed. The welds on all seams are made by working from the center pipe towards the outer bottom plates and back-stepping.



Piston Completed and First Shell Ring in Place.

Seams connecting the inner and the outer bottom should not be welded until after the first shell course is assembled and welded to the outer bottom. All the joints of the outer bottom are left tack welded to expedite the removal of any buckles caused by welding the first course to the bottom. Heavy-coated electrodes should be used in making the continuous welds.

3. The inside circumference of the shell sheets is scribed around the outer bottom plates.

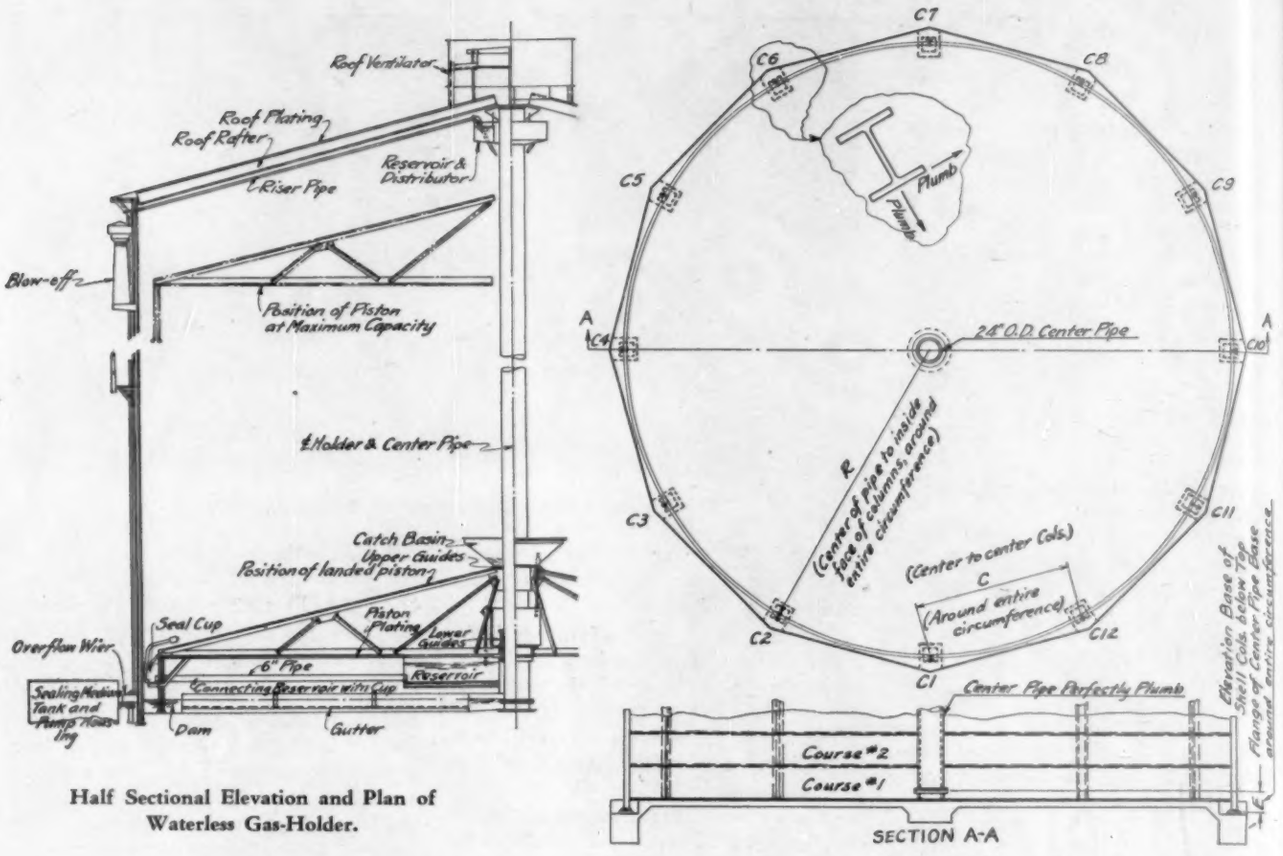
4. The two sections of the center pipe are assembled on a level blocking, so arranged as to facilitate rolling, at the same time keeping the pipe perfectly level and straight through its entire length. The circumferential butt weld joining these two sections of pipe is then made by two welders working at all times on opposite sides of the pipe and 180° apart. This butt weld is made by a multiple bead. The deposit of metal in any one bead is not to be more than ⅛ in. thick. The pipe is to be checked for levelness and straightness after the application of each bead; that is, after each welder has completed one-half of the circle on each side and the pipe has been rotated 180° for the next bead. This work must be done very carefully to absolutely eliminate any possibility of a bow in the pipe. After completion of the weld, the seam is ground off almost flush, then filed and polished until the outside face of the pipe is perfectly true around the entire circumference.

5. The piston gland is assembled on the center pipe, and the pipe is then erected on the base and plumbed perfectly in all directions with steel guy wires. After plumbing, bolts in the lower flange connecting to the base, may be tightened. Use only red lead in this flange joint. The center pipe must be checked or plumbed at regular intervals during the entire erection period of the holder.

6. While the above work is in progress, the piston trusses may be assembled, lying flat, by tack welding. All dimensions are then carefully checked and the welding completed.

7. The first sections of the shell columns are erected around the circumference of the holder with the convex face toward the center pipe. These columns are set on exact centers as shown in the accompanying erection diagrams. The bases of these columns are then leveled up to exact elevation, using the top flanges of the center pipe base as a bench mark. The columns are then plumbed in both directions. (The shell columns are bowed 2¾ in. in the shop, and plumbing must be done from the top to the bottom.)

Looking Down Into the Shell.

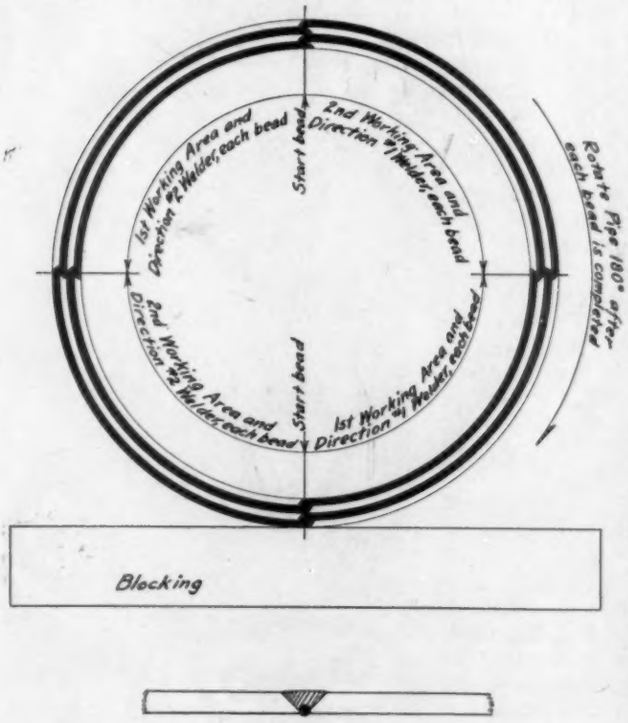


Half Sectional Elevation and Plan of Waterless Gas-Holder.

8. The piston trusses are then assembled around the piston gland, and are blocked up and leveled. The tar cup sections are assembled and fitted to the trusses; the tar storage tank and tar dam sheets are placed around the holder under the piston trusses, but not assembled. The chord members between the piston trusses are assembled and welded. The welding of trusses to the gland and to the tar cup, etc. may now be completed. The piston sheets can then be assembled underneath the trusses and chords and the continuous welds started. All buckles must be removed from these sheets before applying continuous welds. All continuous welds are made by back-stepping and working from the center pipe outward along all seams. Heavy-coated electrodes are used in making continuous welds.

9. After all the piston material is inside the holder, the first two courses of shell sheets may be fitted up between the columns. The bottom of the first course is lined up with the circumference scribed around the outside of the bottom, and is then tack welded to it. Do not perform any continuous seam welding on these courses. The first gallery is now raised and fitted to the top of the columns by tack welding. The elevation of the brackets supporting this gallery is determined exactly, and the radial and chord distance at the top of the column is kept absolutely correct. After assembly of the gallery on the brackets, the columns are checked for plumb; if any are found to be out of plumb, the tack welds holding the gallery sections in place must be cut and the columns moved in or out and held by temporary braces. The object of fitting the gallery at this time is to bring and hold the top of the columns in perfect position on the circle during the erection of the shell sheets.

10. Welding may now be started on the shell. This work is performed as outlined in the various welding diagram sheets shown herewith. The outside vertical welds on the first courses are made, followed by the vertical weld inside; then the horizontal welds on the first course to the bottom are completed. After this, the vertical welds on the outside of the second course are made, then the inside

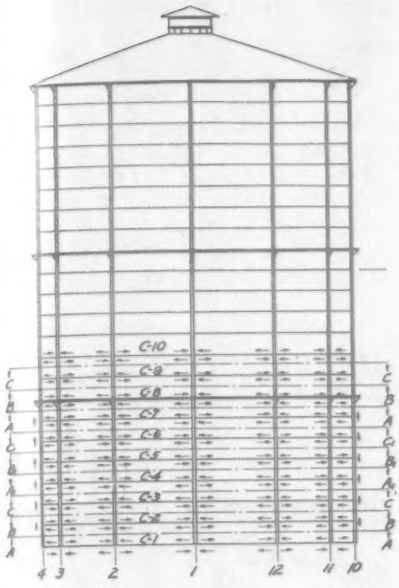

1st Working Area and Direction of Holder, each bead
Start bead
2nd Working Area and Direction of Holder, each bead
Rotate Pipe 180° after each bead is completed
2nd Working Area and Direction of Holder, each bead
Start bead
1st Working Area and Direction of Holder, each bead
Blocking

Procedure for Welding Circumferential Seam of Center Pipe.

The pipe must be leveled and aligned perfectly on the blocking, with the beveled ends together. Two welders work on opposite sides of the pipe and always keep 180° apart. One works upward while the other works in a downward direction. The pipe is rotated 180° after each bead is completed, and alignment is checked after rotation and before the next bead is laid. A cross-section of the circumferential weld is shown at the left.

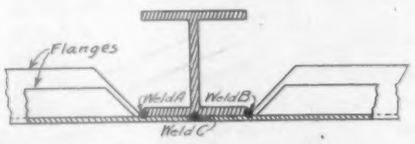
Diagrams Illustrating Step-by-Step Welding Procedure for Gas-Holder Shell

All vertical welds are completed and then the horizontal welds are made. Eight welders are employed, working in pairs. The sequence for making the vertical welds is indicated by the sketch below. When welding the horizontal seams, four welders work outside the shell and four inside. The inside and outside welders of each pair work together in the same bay but in opposite directions on the seam. Welders must change positions around the shell for each ring, as indicated.



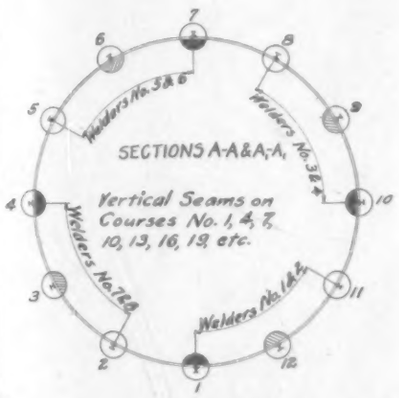
Elevation Diagram Showing Directions of Vertical and Horizontal Welds.

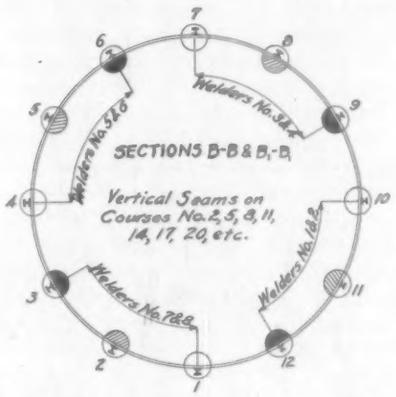
Arrows indicate direction of welding on each sheet in each ring or course. All vertical welds are made upward and with bare electrodes. Directional arrows below the horizontal seams show outside down welds on flanges, made with heavy-coated electrodes. Directional arrows above the horizontal seams show inside welds on flanges, made with bare electrodes.

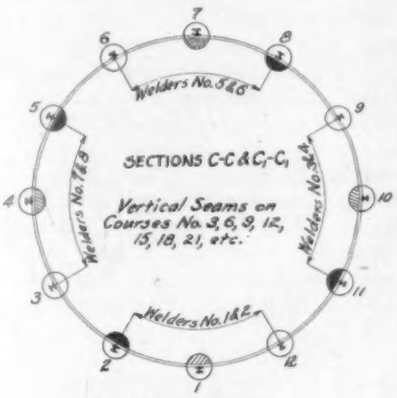


Cross-Section of Column and Plate.

On each course, vertical welds A and B are the first welds made. They are made simultaneously by two welders working on each side of the column. Weld C is made after A and B are completed.





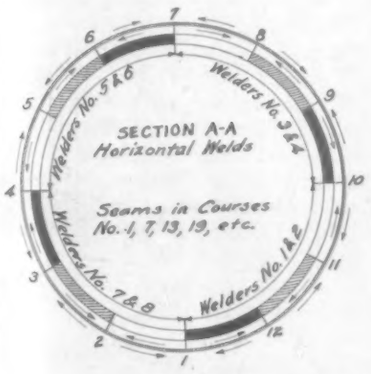


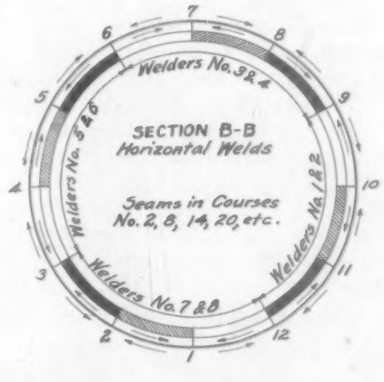
Welding Diagrams for Vertical Seams.

All vertical welds inside and outside the shell are made upward. The outside welds are made first by two welders, one on each side of the column, who work upward at the same speed, after which the single butt weld is made by the welder on the inside seams at this point. The welders work in pairs on columns 90° apart, and move around the scaffold on each ring to maintain this 90° separation. Starting positions on the various courses vary as indicated in the different sections. Vertical welds are made with bare electrodes.

NOMENCLATURE:

- First vertical welds completed in course.
- Second vertical welds completed in course.
- Third vertical welds completed in course.





Welding Diagrams for Horizontal Seams.

For Courses No. 4, 10, 16, etc., the position, sequence and area of work of each pair of welders around the circumference of the shell are the same as for Section A-A, but with the direction of welding reversed from that shown. Likewise, for Courses No. 5, 11, 17, etc., refer to Section B-B, but reverse direction of arrows; and for Courses 6, 12, 18, etc., refer to Section C-C, and reverse direction of arrows.

NOMENCLATURE:

- First horizontal welds completed in course.
- Second horizontal welds completed in course.
- Third horizontal welds completed in course.

welds on this course, and then the horizontal welds connecting the second course to the first course. Heavy-coated electrodes are used on all outside horizontal down-hand welds, and bare electrodes on all vertical and inside welds.

11. The rough vertical welds inside the shell and the plugged fit-up holes at the columns on the first course are ground off flush with the inner face during the welding of the second course. The third course is also fitted up at this time.

12. Work on subsequent courses proceeds in the same sequence. However, by the time the fourth course is completed the piston should be complete, the temporary seal in place, and the piston blown up to enable the workman on the inside to use it as a scaffold. In raising the outside scaffold, the welders must drop down and plug the fit-up holes on the lower flanges, previously blocked by the scaffold brackets.

13. When the assembly and welding of the shell is completed up to the first gallery, it is checked and is rounded up, if necessary, before the complete welds are made. The gallery forms a circular girder at this point and, when welded, should hold the shell perfectly round. In making continuous welds of gallery sections, the same sequence should be used as in making course welds; that is, the ends of sections are welded first, followed by the circumferential welds by which the gallery plates are attached to the shell. The welders work 90° apart at four points around the shell at all times, to compensate for shrinkage. The stairway is fitted up to the first gallery after welding.

14. All work in the erection of the second and third sections, including columns, shell sheets, and galleries, is to be performed in the same sequence as in the first section.

15. As soon as the erection and welding of the shell sheets in the third section reach a point where the guy wires to the center pipe interfere with the work, the radial roof girders are then placed from the top of the pipe to the top of the columns. The length of these beams, as fitted, must be exact. Sufficient chord members should then be fitted and welded between them to hold them rigid. With this done, the guy wires may be removed, and the assembly and welding of the upper part of the shell continued.

16. All roof members are then fitted and welded in place. The roof sheets are assembled over these members by tack welding. Any unevenness or buckles in the roof plates must be removed by cutting the tack welds and reassembling. This may be assisted by angle cleats or clips welded on the chord members underneath the roof to make it conical. These clips are used in the same manner as the cleats on the purlins underneath a gas-holder crown. The roof must present an absolutely uniform appearance before the continuous welds are made. These welds are made by back-stepping along the seams, working from the center of the holder outward.

17. When the roof is completed, the piston is lowered slowly. All sheets and seams are carefully examined for rough spots and omissions in welding. After the piston lands on the bottom, the tar storage tank is attached, and the tar piping, tar-cup mechanism, rubbing bar and permanent tar seal are installed for operation.

The purpose of the erection diagrams shown herewith is to indicate the direction of welding on all seams, together with the movements of the welders around the circumference of the shell in making the inside and outside continuous seam welds.

The set-up contemplates the use of eight welders on this work, who have been numbered respectively from 1 to 8. Their relative working positions in making the welds on each ring is shown in the sectional diagrams and must be held to rigidly to compensate for shrinkage stresses and to prevent distortion. Starting points must be marked and direction of welding indicated on all seams of each ring, and these checked to insure the correct sequence in applying the welds.

To some engineers, the detailed procedure outlined may seem to be too elaborate, since too many instructions tend to impede the erector in his duties. However, when the preliminary studies are made in conjunction with the field forces, the resulting instructions benefit all concerned, as is evidenced by the successful erection of the structure under consideration.

Welded Structural Steel to Be Topic at Chicago

"Welding and Its Application to Structural Steel" will be the subject of a paper to be given by L. K. Whitcomb, of the Cleveland office of the Carnegie Steel Co. before a joint meeting of the Chicago Section of the American Welding Society and the Bridge and Structural Section of the Western Society of Engineers, to be held on the 12th floor of the Engineering Building, 205 W. Wacker Drive, at 7 p. m. on April 23rd. The lecture, which will be accompanied with slides, will deal with fundamental details of design, stress distribution, and suggested fields of application.

At the meeting of the Chicago Section of the American Welding Society held on March 23rd, a paper on the welding of manganese steel was read by E. L. Quinn, of the American Manganese Steel Co. This was followed by a talk by Jules Muller, chief engineer, Hollup Corp., on selecting correct electrodes for various welding jobs.

Aluminum Coating Cuts Down Heat Radiation

An all-welded steam boiler, coated with aluminum to cut down heat radiation, is being manufactured by the General Welding Products Co., 901 Massachusetts Ave., Indianapolis, Ind. This boiler is designed for furnishing live steam for clothes-pressing machines or for other applications of similar steam requirements. The illustration shows one of the boilers being sprayed with aluminum by means of a metal-spray gun. Coal, coke, oil, gas, or gasoline can be burned, says A. O. Wanger, general manager of the company, and the firebox is of extra large capacity.

The boiler is of ¼-in. flange-quality steel throughout and is welded by the Lindeweld process, using No. 25 rod. Though originally developed for pipeline work, this procedure is very satisfactory for this application, and is said to result in high speed and low cost, at the same time producing a weld of high quality.

Spraying Welded Boiler With Metallic Aluminum.

After being welded, the boilers are sandblasted and then aluminum is applied to a thickness of approximately 0.010 in. over the entire outside surface of the boiler as well as firedoor casting and funnel. Angular steel grit is used for sandblasting, the work being done in a chamber built for this purpose. The welded nipples are closed with plugs, as shown in the photograph, these protecting the nipple threads from the sandblast as well as from the aluminum spray.

The aluminum coating is more efficient in the saving of heat than the usual asbestos paper, and it prevents rust and corrosion, at the same time improving

the appearance of the boiler. The aluminum cuts down the radiation of heat from the boiler surfaces to such a great extent that when one's hand is held 2 in. from the boiler shell, the heat is barely noticeable, and cannot be felt at a distance of 4 or 5 in., although at the same time the hand will be burned if it actually touches the coated surface.

A test made on a boiler of the gas-fired type showed an increased efficiency of approximately 25% after being coated. The boiler without a coating required 21 minutes to produce 80 lb. of steam from water at room temperature, and after coating the same boiler with aluminum only 16 minutes was required to raise steam starting with cold water.

Most clothes-pressing establishments install these boilers in the pressing room, and the radiated heat raises the temperature of the room to an uncomfortable degree, and in the summer season is almost unbearable. The reduction in radiated heat not only raises the efficiency of the boiler but also increases the production of employees by maintaining a lower room temperature.

Pavement Rooter Welded From Scrap Materials

By W. E. ARCHER

Credit falls to the welding crew of the Pipe Line Department of the Richfield Oil Co. at Signal Hill, near Long Beach, Calif., for the construction of an interesting and very effective piece of home-made equipment, known as a pavement rooter, built entirely by the use of an acetylene cutting torch and electric welding, and made of material salvaged from the company's pile of junk iron and pipe. This tool is used in tearing out asphalt and similar pavement at points where a pipeline crossing a street or highway must be removed or taken up for repairs, new connections, etc.. Months of actual service with this tool has shown it eliminates much hand labor with picks, chisels and jackhammers.

This rooter is about 8 ft. long, the main frame being made of a piece of a 15-in. extra-heavy I-beam cut to the proper shape to form the "business end," or point, of the rooter, as shown in the illustration.

The seat for the "rider," who assists in the operation of the rooter by riding it and helping to hold it steady, is directly over the point, as shown, and is made of a scrap piece of an 8-in. H-beam which is welded securely to the top of the heavy I-beam. The post and handles for the rider are made of 3-in. drill pipe securely welded at the base, with a piece of 2-in. scrap pipe welded across the top. The handles at the back end are of 1-in. scrap pipe.

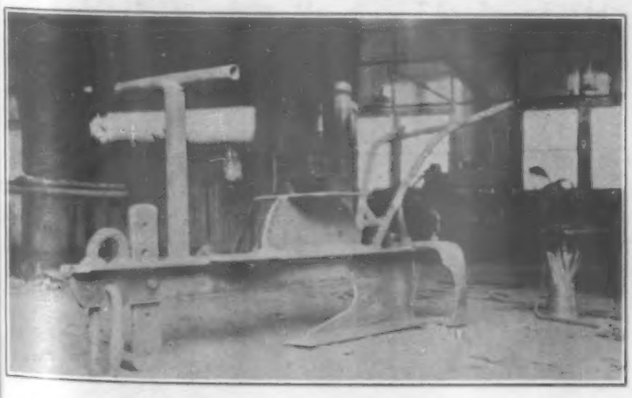
The pulling ring and link were salvaged from an old piece of heavy chain, and solidly welded, the ring being welded to the top of the beam, and the link being cut and put through a hole cut in the end of the beam and then welded, as shown.

A skidding shoe for controlling the depth to be rooted is made of a piece of 1x4-in. strap iron, for the supporting leg, which is installed directly behind the pulling link. Four holes are drilled for bolting to the beam and for setting at the desired depth. The shoe proper is made of a heavy piece of steel cut in a runner shape and welded to the bottom of the leg. The front surface of the shoe is hard-faced to better withstand the extreme wear to which it is subjected.

A U-shaped side cutter for shearing the sides of the pavement and thus eliminating irregular edges, is attached at the rear, as shown. The points and cutting edges of this side cutter, as well as the main point of the rooter itself, also have an application of hard-facing. The hard-facing, as well as all of the welding on the rooter, was done by the electric process. The acetylene torch was used only for cutting.

Since a considerable portion of the I-beam forming the main part of the tool has been cut away to obtain the peculiar yet necessary shape, the strength of the beam, is, of course, materially reduced. In order to offset this reduction in strength, the idea of welding the H-beam forming the seat for the rider directly over the weak point was carried out, with the gratifying result that sufficient reinforcement was thus provided. This strengthening feature prevents buckling when an unusually hard strain occurs, such as when encountering unseen obstructions. As the rooter is pulled by a large crawler-type tractor, and only a very sturdy tool could withstand such service, this feature has been proven practical and effective many times by actual trial.

This tool was made complete in 8 hours by one man, which included picking out the material, laying out the work, cutting, welding, etc.



All-Welded Device for Tearing Out Paving, Is Speedier Than Picks and Jackhammers.

Arc-Welding Handbook in Enlarged Edition

A new enlarged edition of the "Procedure Handbook of Arc Welding Design and Practice" has just been issued by The Lincoln Electric Co., Cleveland, Ohio, owing to the exhaustion of the original issue published last fall. Orders for this book have been received at the rate of more than a thousand a month.

The new edition contains the following added material: weld inspection (visual, stethoscopic, electro-magnetic, x-ray, and gamma-ray); study of stress distribution by means of polarized light; a simplified method for the design of arc-welded machinery; procedure and speeds for arc-welding aluminum and copper; construction of welded water lines, etc. The original edition of this book was reviewed in *The Welding Engineer* of October, 1933.

Discussion on Qualifying Tests for Welders

The March 15th meeting of the Los Angeles Section of the American Welding Society was presided over by the newly elected chairman, Frank Longo. The program consisted of a talk by W. F. Stoody, president of the Stoody Co., Whittier, Calif., on hard-facing materials and their application. Following Mr. Stoody's talk, a discussion was held on qualifying tests for welders; those present showed such an interest in this subject that it will probably be featured at an early meeting.

French Welding Journal Observes 25th Anniversary

Revue de la Soudure Autogène, published monthly in Paris, celebrates its 25th anniversary with a special February number containing a great deal of historical and technical information on gas welding furnished by many collaborators. This issue is bound in metal foil with an attractive embossed design.

Modernizing a Blast Furnace

■ Erection problems of an unusual nature were easily solved with the help of the cutting torch and welding arc, when adding new gas outlets.

THE first time welding has been applied to the fabrication and erection of blast furnace uptakes and downcomers was in a recent remodeling job on a blast furnace at the plant of the Alan Wood Steel Co., Conshohocken, Pa. These all-welded gas outlets replaced the old style of outlet and were constructed by H. A. Brassert & Co., of Chicago. Supporting brackets and other construction pertaining to the same job were also welded.

It was decided to use welding for this job solely for reasons of design and economy, and, as matters turned out, this type of construction was a boon for the erectors, since it permitted needed alterations on the job at small additional expense and little outlay of time. Such alterations were made necessary by the impracticability of obtaining field measurements of the existing blast furnace and the unreliability of old blueprints showing the original construction. Moreover, the blast furnace structure is subjected more or less to warpage, which further complicated the problem of making a design that would fit the existing structure.

This furnace formerly had six short gas outlets leading from the top down to the two downcomers, which are the two slanting pipes, 5 ft. 9 in. inside diameter, of riveted construction, shown in the accompanying photographs. With the completion of the four all-welded uptakes and connections to the downcomers, the original six outlets have been eliminated. The new design has the advantage that coke, ore and other materials blown out of the top of the furnace are deflected at the end of the uptakes and fall back into the furnace instead of being carried over with the gas into the dust catcher.

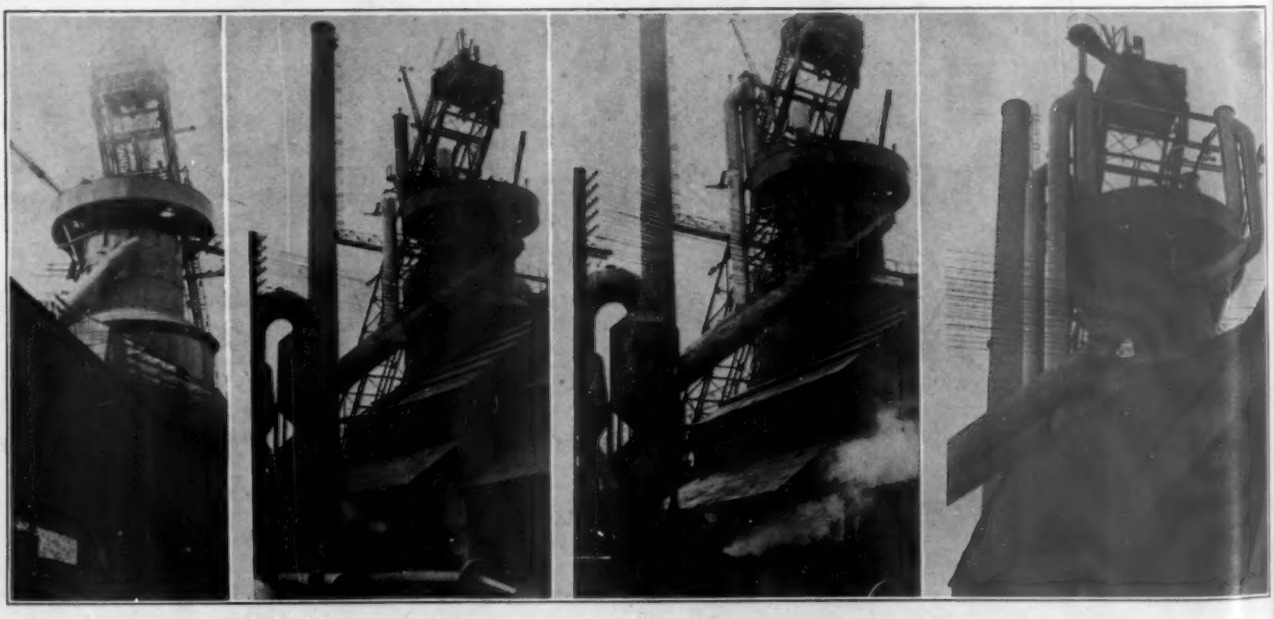
The gas at times travels at very high velocity, with the result that small particles carried with it have a serious eroding action against the outside wall at each elbow of the pipe or wherever the direction of movement of the gas is changed. At these points of wear, wearing plates are inserted inside the pipe and held in place with bolts, as the illustrations show. To replace these wearing plates, it is only necessary to burn off the ends of the bolts from the outside of the pipe and drive out the bolts, thus releasing the plate.

Field Welding of Uptakes and Connecting Legs

The welded uptakes and connections to the downcomers are made from 3/8 in. steel plates, formed and welded to make a pipe 4 ft. in diameter. Though each uptake and the vertical pipe connecting it to the downcomer form a complete structural unit, the uptake as well as the connecting pipe is welded to make two sections in the fabricating shop, necessitating five field welds, as follows: Lower section of the uptake welded to the blast-furnace shell; lower section of the connection pipe welded to the downcomer; each of the two upper sections welded to their respective lower sections; and both upper sections welded together.

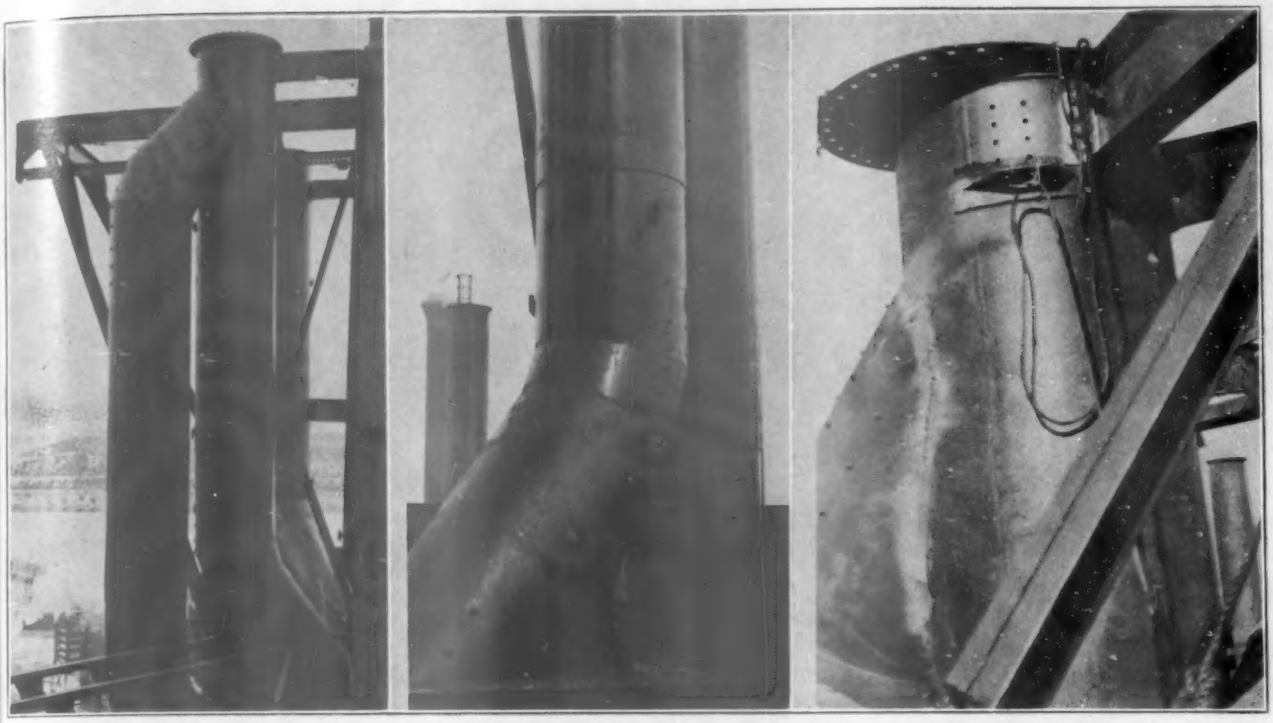
Other field welding was required on the brackets, made of angles and plates, which support the uptakes and are welded to the uptakes and blast-furnace shell. Welding was also used to fasten a beam to the skip truss for anchoring the A-frame for hoisting the furnace bell and hopper; riveting the beam was out of the question here since the details of the truss were not known. Field welding also saved labor and expense in relocating one of the struts connecting the tops of two of the uptakes; rivet holes and angles had been provided for making the connections, but stairs were in the way, making it necessary to move the beam, which was readily accomplished by welding the ends in place and plugging up the rivet holes in the uptakes with weld metal.

The field joint in each of the four



Views Showing Progress in Erection of Uptakes and Downcomers.

(The old gas outlets have been removed, but the riveted downcomers have been left in place. The four new all-welded uptakes and downcomers lead into the former downcomers.)



Details of All-Welded Uptakes and Downcomers.

(The ends of the bolts holding the wearing plates in place are clearly visible, and in the first two views the field-welded slip joints are seen, as well as the lugs welded to the sections to facilitate handling. In the third view can be seen the end of a beam which had to be repositioned because of an obstruction; it was welded in its new position, and the rivet holes plugged up with weld metal.)

connection pipes between the uptakes and the downcomers was designed as a slip joint, the upper section fitting over the lower section and allowing a maximum of 12 in. of vertical movement to compensate for errors in the location of the downcomer. This field joint was welded both inside and out. Where the pipe was to enter the downcomer, a hole was marked out and cut, through which the bottom of the pipe was inserted. Then a flange, made of plate formed to an angle section, was fitted closely around the joint and welded in place, after which a cutter inside the downcomer cut off the end of the pipe flush with the inside wall of the downcomer.

Extending upward from the top of one of the uptakes is a 20-in. bleeder pipe, also of all-welded construction, as one of the illustrations shows.

Handling the Sections in the Field

A difficulty encountered in a job of this nature, where erection bolts are out of the question, is the fact that each welded section of pipe must be absolutely in plumb before tack welds are made. In this case, small erection lugs were welded to the pipe to provide places for anchoring tackle, hanging scaffolds, etc., thus facilitating handling of the welded sections after they arrived from the fabricating shop. As it was not necessary to remove these lugs, many of them were left on after completion of the work; these will be of material aid from time to time in supporting scaffolding, etc., for painting, for replacing wearing plates, or for other repair work.

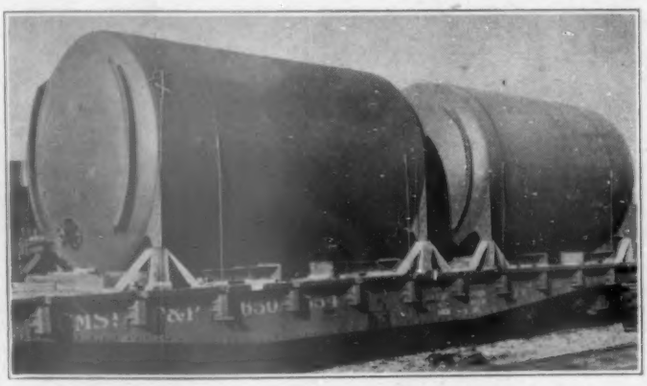
All-Welded Tanks Sprayed With Glass Lining

Glass-lined all-welded tanks for brewery service are being manufactured by the A. O. Smith Corp., Milwaukee, Wis. This construction results in a single-piece tank which, like a beam, can be supported entirely at its ends and needs no intermediate supports. The glass lining inside the tanks eliminates the need for pitching.

These tanks are made from long, flat sheets of steel, which are rolled into large cylinders and electrically welded together to make the length desired. The ends of the cylinder are closed with dished heads, also welded in place. After the required openings are cut with a torch, the manway and the various connections are welded to the tank.

Men inside the tank sandblast the interior to make it absolutely clean, after which they use special spray guns to apply the lining material to the interior surface. The tank is then placed in a huge furnace, which meanwhile has been heated to the whitehot point. During the subsequent firing the heat fuses the sprayed material to the steel, after which the tank is removed from the furnace and allowed to cool from the whitehot heat. It is then tested. If more than one coat is desired, the process is repeated.

The glass lining possesses such elasticity and adhesion that it cannot be cracked or chipped off by hammering with a hardwood mallet, nor by bending within the elastic limit of the steel plate.



These Glass-Lined Tanks, When Installed, Will Be Supported Only at the Ends, Their Construction Rendering Intermediate Supports Unnecessary.

The "Zephyr" —a Product of Welded Design

Stream-Lined Train Opens New Era in Railroading

A SILVERY shaft of stainless steel, 196 ft. long, is the impression the observer receives as he obtains his first glimpse of the "Zephyr," the new high-speed streamlined passenger train built by the Edward G. Budd Manufacturing Co., of Philadelphia, for the Chicago, Burlington & Quincy Railroad for operation on their lines between Kansas City, Omaha and Lincoln. Before being put into service, the train will be exhibited in principal cities from coast to coast as well as at A Century of Progress Exposition in Chicago.

The train has three cars, but has only 16 wheels instead of 36 for the conventional 3-car train. The rear of one car and the front of the succeeding one rest upon the same truck. The train, therefore, might be described as a long, articulated car.

The purpose in building a train of this type is to obtain high economy in operation, comfort for the passengers, and high speeds. In attaining these aims, welding played a very important part.

The framework or skeleton embodies the scientific latticed method of construction with the parts secured by the "Shot-weld" process of welding, in which each "shot" of electric current is precisely timed, resulting in absolute uniformity in the welds, thus unifying the sections effectually without any breakdown of physical characteristics of the metal. Practically all the structural material is of 18-8 stainless steel.

Each Car Supported Directly on Its Trucks

Built integral with the ends of each car are heavy members or piers which rest upon the trucks, instead of the car resting upon a frame or sill as in the conventional design. Thus each car acts like a bridge or a truss supported at its ends. All horizontal and vertical stress members and weight-sustaining parts in the train's framework consist of U-shaped struts and beams to obtain high strength and light weight.

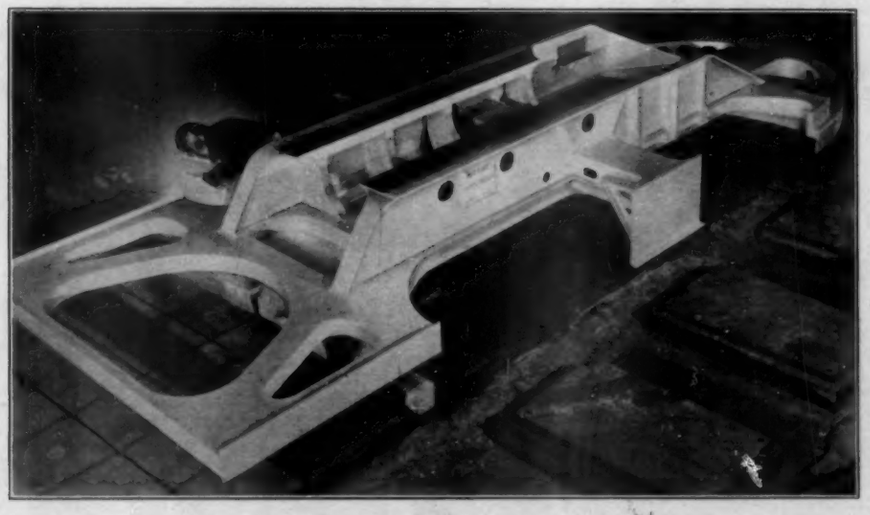
The engine bed, or chassis of the motive-power unit, is also constructed by welding, having been fabricated by Lukenweld, Inc., of Coatesville, Pa., from Lukens "Cromansil" steel, which is a recently developed, high-strength material. This application is believed to be the first instance of the use of a welded steel engine bed on a motive power unit employed in main-line railway service in this country.

The engine bed supports a load of approximately 60,000 lb., consisting of a 600-hp. Winton full-Diesel engine and General Electric generator, which power the train, and the forward half of the power car. This 30-ton dead load imposes severe impact stresses on its supporting bed under the operating conditions encountered in service. The stresses are of a fatigue nature, since they are repeated many times per mile.

Great Variety of Loads Impose Severe Stresses

Because of the infinite variety of types of load to which the structure is subjected in service, analysis of the loads is highly indeterminate. Rail joints, switches and crossovers cause vertical impact. Acceleration and deceleration result in horizontal stresses of variable extent. Movement around curves at speed produces lateral stresses. Combinations of the various forms of stresses can occur simultaneously. The requirements of service are further complicated by the necessity of minimizing weight. Naturally, the working stresses are high.

In developing the design of the engine bed, particular attention was given to the elimination of rectilinear elements which would involve undesirable concentrations of stress. Angles, channels and "picture-frame" correlations were avoided because they would result in severe changes in contour which, in turn, would be incipient points of failure.



Light-Weight All-Welded Bedplate for Diesel Power Unit.

In referring to the illustration of the engine bed, one notes that the design utilizes extremely moderate changes in contour, which not only avoids concentrations of stress but also introduces a high degree of redundancy. The mutual interaction of adjacent members is an important element in the functioning of the structure as a single unit rather than as a connected assembly of individual members.

The engine bed is located in the front half of the first car of the train and is joined at the rear to the stainless-steel structure forming the remainder of the car.

Welded Construction for Light-Weight Crankcase

The crankcase of the 8-cylinder, 600-hp. Diesel engine is also of welded construction, being formed from "Cromansil" steel plates joined by welding, instead of castings. The engine, without generator and auxiliaries, weighs only about 22 lb. per hp., which low ratio is largely the result of efficient design and fabrication in welded steel construction. This engine is the first of its type ever used for rail transportation in this country.

The entire train weighs 95 tons—about the weight of one Pullman car—yet the strength-to-weight ratio is greater than with any other type of construction. It will seat 72 passengers. The center of gravity has been perceptibly lowered compared with conventional designs.

Not Even a Rivet Head to Create Air "Drag"

Advantage is taken of the most modern application of scientific streamlining, in which the contour of the front and rear ends, the design of the wheel guards, the concave fluted sheathing of the sides, top and under surfaces, absence of rivet heads, and flush window frames, all help to eliminate the "drag," which steals so much of the energy when the train is accelerating.

All passenger compartments are air conditioned, the windows sealed, and the temperature thermostatically controlled. The chair frames, though light, are comfortably upholstered. Overcoat and hat are stowed in a metal rack fastened to the back of each chair, and hand luggage is disposed of in a roomy space under the seat. Overhead racks are eliminated.

Safety and Convenience to Passengers

All windows are of shatter-proof glass. Glare is eliminated by indirect lighting. Everything is arranged for comfort and convenience, even to the buffet-grill dishes, which are rendered more serviceable by eliminating the conventional 2-in. bevel and substituting a half-inch rim.

Suffers Injuries When Plane Cracks Up

In a crack-up of his airplane, which occurred on March 3rd, Elmer H. Smith, president of the Smith Welding Equipment Co. and of the Commercial Gas Co., both of Minneapolis, Minn., suffered a fractured jaw and loss of several teeth, as well as many bruises and a severe shaking up. The plane was a total loss. Mr. Smith was confined to bed for 10 days, but his condition showed no evidence of internal injuries, so since that time he has been allowed by his doctor to give some time to his business. The accident occurred as Mr. Smith was attempting a landing. For a considerable time, Mr. Smith has been an aviation enthusiast and, more recently, a student with a credit of about 25 hours solo flying.

Welded Water Skis for Duck Hunters

All-welded water skis, to enable duck hunters to get through rice fields and marshes where progress in a boat is almost impossible, are being manufactured

Water-Tight Skis for Marsh Country.

and marketed by Dan McInnis, of the Security Welding Co., 107 First Ave. North, Minneapolis, Minn.

Mr. McInnis, an enthusiastic duck hunter, made his first pair of skis to enable him to reach desirable "blind" locations. Then some of his friends wanted them, so now he is producing them for the market.

The skis are made in two sizes—7 and 8 ft., weighing 17 and 19 lb. respectively. An air chamber in each end prevents them from sinking if overturned. Though originally developed for marshes, they will operate equally well in deep water, some considering their use in this manner as great sport. It is said that any one can handle the skis easily after one or two trials.

Stainless Steel Is Topic at Philadelphia Meeting

"Welding Stainless Steel" is the subject of a talk by Dr. T. Hollard Nelson, consulting metallurgist and engineer, scheduled to be given before the annual meeting of the Philadelphia Section of the American Welding Society on April 16th at the Engineers Club, in Philadelphia. It is announced that the Section will hold no meeting in May.

Training Course in Radiography

A practical training course, of four days' duration, on how to make and interpret radiographs, will be offered by the St. John X-Ray Service, Inc., at their laboratory at 30-20 Thomson Ave., Long Island City, N. Y., during the week of July 2nd. Morning and afternoon sessions will be held on the 2nd, 3rd, 5th and 6th. The date for this special course immediately follows the A.S.T.M. meetings in Atlantic City. The course is prepared especially for out-of-town people, with a view to the needs of metallurgists, welding engineers, and inspectors.

The program will include such topics as the physics of x-rays, x-ray tubes, production of x-rays; intensity, quality, absorption and scattering of x-rays; diaphragms, centering of tube, intensifying screens, correct exposure, strength of current, focus-film distance, thickness and nature of object, photographic process, reproducing negatives, contrast in negatives, wave-length, screens, double-exposure, thickness determination, Boiler Code discussion, weld inspection, practical tests, demonstration of defects, pressure-vessel inspection, operating and cost data, gamma-ray inspection, specifications for inspection of castings, interpretation of defects in cast steel, practical tests, small-casting technique, etc.

The theoretical part will be dealt with rather briefly, and merely the influence of the various factors upon the results in a good negative will be demonstrated. A fee will be charged, which will include the use of equipment and materials.

Battledeck Floor Performs as Single Unit

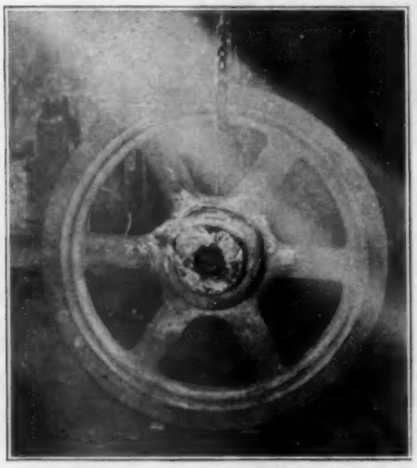
A test of a battledeck floor, consisting of flat steel plates welded aolng their seams to I-beams spaced 24 in. on centers, indicates that for ordinary spans the entire width of the floor may be assumed as being effective, if the spacing of the beams does not exceed 100 times the thickness of the plate; that is, the entire floor behaves as one unit when loads are applied. Details of the test and interpretation of results are given in the March, 1934, *Bureau of Standards Journal of Research*, published by the Bureau of Standards, Washington, D. C.

Saginaw Valley Welders Form Organization

The Saginaw Valley (Mich.) Welding Contractors Association was recently formed, with officers as follows: President, Erwin Wiltse, of Saginaw; treasurer, Earl Massol, of Reece; and secretary, Tom Bedell, of Bay City. Plans are going forward for affiliation with The National Association of Welding Contractors, Inc.

Repair Requires Careful Preheating and Cooling

Correct procedure in the handling of the preheating fire enabled the Anchor Welding Service, Inc., of Chicago, to make a successful weld in a heavy flywheel having two breaks completely through the hub. The welding of a flywheel such as this one, having an extra-heavy-reinforced hub, presents unusual problems in contraction and expansion. Failure to take account of these forces will often cause welds to fail while cooling or will set up such high contraction



Flywheel With Reinforced Hub, After Repairing Breaks By Welding.

strains that a failure occurs soon after the wheel has been put back in service.

This flywheel was from a punch press, and had a diameter of 4 ft. and a rim 7 in. wide. The hub was 4½ in. thick and the length (bore) was 10 in. Having a heavy rim and hub, it made preheating more of a problem than would a light-type wheel of the same diameter.

The wheel was prepared for preheating by laying it on its side, resting on firebrick so it was firm and squarely supported. A preheating furnace was then built of firebrick, and a fire was started in the region of the rim only, so the rim would expand and there would be no tendency for the spokes to expand and try to push through the rim. As the rim heated and expanded, the charcoal fire was gradually pushed in towards the hub. Care was taken to move the fire evenly, all around the wheel, a little at a time.

When the fire had reached the hub and the casting was hot all over, more charcoal was added and allowed to come up to a dull cherry heat. The furnace was kept covered with asbestos paper. The preheating required 6½ hours.

With the casting at the right heat for welding, only enough of it was uncovered to allow two welders with No. 15 welding tips to get at the two breaks. Owing to the excessive heat, a third welder was required for relief. The breaks were melted out half way through with the welding tips and then welded. Reinforcements were also added for additional safety.

When one side was completed, a crane was used to turn the wheel over onto its other side. After the welding was finished, it was necessary to equalize the heat—that is, make the wheel approximately the same temperature all over. It may be necessary at this point to add more charcoal, if the preheat has died down to a considerable extent. A good, experienced operator will keep the temperature of the casting up at all times.

Now, with the flywheel at a dull cherry red all over, and the welding completed, the casting had to be cooled off very slowly in order that it might be fully annealed and free of strains. Therefore, the preheat fire was moved back to the rim or the outer edge of the round furnace in order to keep the rim expanded so it would not draw down on the expanded spokes but would be the last part of the wheel to cool off.

The entire furnace was then covered over with asbestos paper so there were no holes through which the heat might escape except through a hole poked through the asbestos over the center of the hub. This was done to compensate for the mass of metal forming the hub, which required that some method be used to cool the hub slightly faster than the rest of the wheel or it would result in a cold rim with a warm hub which would mean the setting up of heavy strains in the wheel and perhaps a check.

After the flywheel was cool, it was removed from the furnace and cleaned up. After its delivery to the customer, the bore of the hub was dressed and the wheel replaced in service.

A total of 15 blow-pipe hours was required and 110 lb. of cast-iron welding rod used.

Proper preparation, including preheating, and proper care after welding, is the best insurance that a job will stand up, says George Hettrick, president of Anchor Welding Service, who personally supervised the preheating and annealing of this casting, as he does all other complicated castings which his company welds. Mr. Hettrick points out that a casting, properly welded, will give the same service as a new casting and in many cases will be superior because it is thoroughly and properly annealed whereas many new castings, particularly those cast in a green mold, cannot be said to be strain-free.

Large Stainless-Steel Order From Navy

The American Rolling Mill Co. reports an order received from the U. S. Navy for 400,000 lb. of stainless-steel sheets, involving $175,000.

Kroger Bakeries Adopt All-Welded Flash Pans

Adopting the principle of the non-spillable ink well to flash-pan design has enabled Mitchum & Schaefer, Inc., of Indianapolis, Ind., to improve materially The Kroger Baking Co.'s method of baking bread.

In the larger bakeries, bread is baked in traveling ovens. Flash pans are used to keep the flash heat from the first rows of bread as they pass through the oven. For this purpose, plain, open-top pans filled with water have been used, but these had a disadvantage in that the water was easily spilled, thereby causing damage or delaying production.

By designing and welding the flash pans as shown in the photograph, Mitchum & Schaefer have produced a product that can be tipped to almost 45°, even when half full, without spilling out the water, and yet these pans have all the advantages of the former type of pan.

Each pan is 34 in. long, 4¼ in. high and 8 in. wide and is constructed of 14-gage metal, either steel or aluminum, all welded. The steel pans are welded with the arc and the aluminum pans are welded with the oxyacetylene flame.

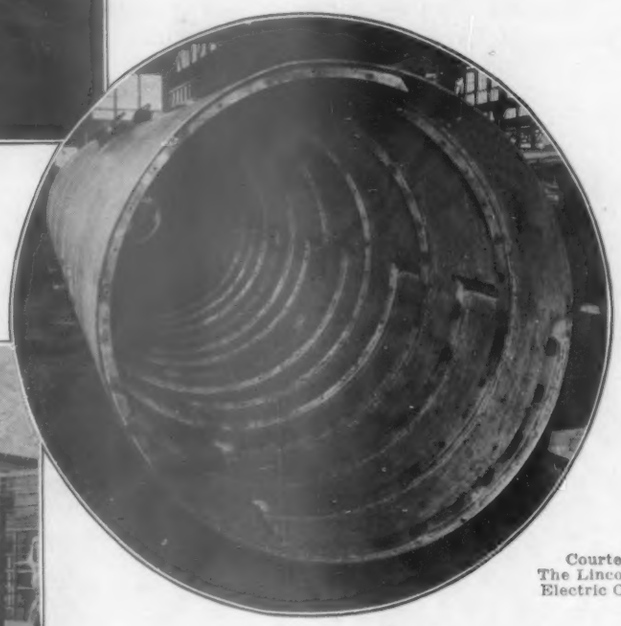
It is reported that the Kroger Baking Co. are replacing all their old flash pans with this new type of welded non-spillable pan.

All-Welded Pans Designed on the Principle of the Non-Spillable Ink Well.

WELDING NEWS
▪ IN PICTURES ▪

Courtesy H. C. Price, Inc.

Electric Welding on Douglas-Phoenix Gas Line, Near Picacho Peak, Arizona.

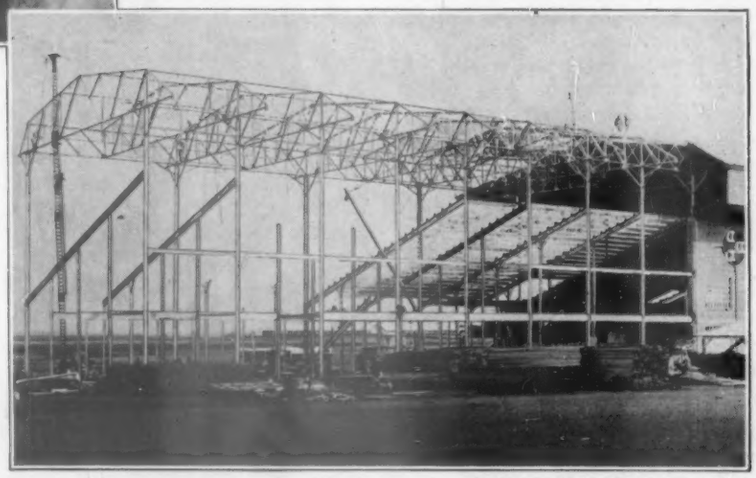


Courtesy
The Lincoln
Electric Co.

Arc-Welded Stainless-Steel Fractionating Tower for Distilling Fatty Acids. The Inner Angles Are for Supporting Bubble Trays, Which Also Are Welded.

Courtesy Hobart Bros.

Arc Welding the Framework for a Combined Garage and Glass-Covered Swimming Pool.



Courtesy Metal & Thermit Corp.

Race-Track Fans Can Sit on Welded Bleechers This Summer as They Watch the "Ponies" at the Arlington Downs Race Track, Near Ft. Worth, Texas. This 160x108-Ft. Addition to the Present Grandstand Is of Partially Welded Construction, about 50% of the Field Connections Being Arc Welded, as Well as 80% of the Shop Work (Excluding Trusses). When It Was Decided to Relocate a Mezzanine Floor to Be Built at the Same Time on the Main Grandstand, Considerable Time and Expense Were Saved By Welding the Mezzanine Floor to Its Supports in Its New Location.

Furnaces of Welded Steel Have Permanently Gas-Tight Joints. The Manufacturer of This Oil-Burning Furnace Guarantees It Will Not Admit Oil, Oil Vapor or Combustion Gases to the Air Chamber. The Design Incorporates Long Fire Travel and Large Heating Surface.

New Equipment

Small Carbon-Arc Welder for Rare Metals

A small-capacity carbon-arc welding unit, intended primarily for the soldering of the rare metals used in the dental and optical fields, or for light manufacturing

Carbon-Arc Soldering Unit That Can Be Operated From Light Socket.

operations, is being marketed by Thomsen, Uherka & Co., 248 Foshay Tower, Minneapolis, Minn. The illustration shows Unit A complete. Through the use of the 2 plugs and 7 jacks shown, the heat can be varied from 1100° to 5200° F., it is claimed. The device can be operated from any light socket providing 60-cycle, 110-volt current.

Makes Change in Design of "Sight Feed" Generators

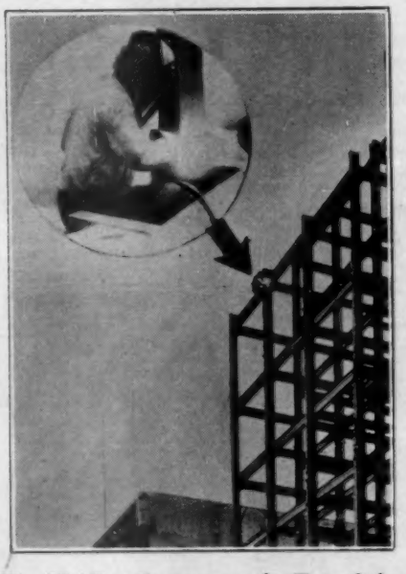
A recent change in the design of the acetylene generators manufactured by the Sight Feed Generator Co., West Alexandria, Ohio, not only improves the appearance of the generators but also materially lessens the time required to remove the hopper. In the new design, the hopper is directly fastened to the generator chamber by means of a "breech lock" device, thus eliminating the three turnbuckles formerly used to fasten the hopper to the neck of the generating chamber.

New Westinghouse Line of Resistance Welders

A new line of spot and projection welding equipment for manual or motor operation has been developed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The electrode arms of these welders provide sufficient stiffness and still have proper conductivity. Both arms may be moved toward or away from the frame or may be rotated. The lower arm can be swung to one side or the other. The electrode tips are made from "Cupalloy," which is a special copper alloy developed by the Westinghouse Research Laboratories. These tips, it is said, have a conductivity of 85 per cent and a Brinell hardness of 95 or more. These machines are available in many types and sizes and with various types of automatic or manual control.

Voltage Control From Far Point Without Extra Lead

Savings up to $500 per year per welder, higher quality welds, increased weld output—these are results claimed for a new remote control device for arc-welding machines announced by The Lincoln Electric Co., Cleveland, Ohio. The device is known as "Lincontrol." No additional cables or other apparatus need be carried by the operator.



The Welding Operator at the Top of the Building Adjusts the Voltage of the Welding Unit Below Merely by Tapping This Electrode on the Work.

The operator taps the electrode on the work several times—the voltage is automatically raised! A larger number of taps, and the voltage is lowered! Thus by merely tapping the electrode—making and breaking the electric circuit—the current output of the generator is controlled.

With "Lincontrol" the operator can work at any distance from the machine and regulate the current accurately without making trips back and forth to adjust the controls. It is particularly convenient after starting up with a "cold" machine to be able to change the current setting as the machine warms up, without having to leave the work and go to the machine to make adjustments. The same thing applies to changing from horizontal to vertical welding, or the reverse.

In shipyard work, where the average welding operator spends approximately 15% of his time in actual welding, "Lincontrol" increases the operating factor as much as 100%, it is claimed.

With "Lincontrol," there is no temptation on the part of the welder to use the original current setting rather than return to the machine and reset the controls. Hence, it permits the use of the most efficient electrodes and therefore insures the highest possible speeds.

"Lincontrol" involves the use of no additional cables or rheostat. Its mechanism is encased in a small box which may be quickly attached to the welder voltage control. No additional apparatus of any kind is necessary. The regular hand controls may still be used as desired.

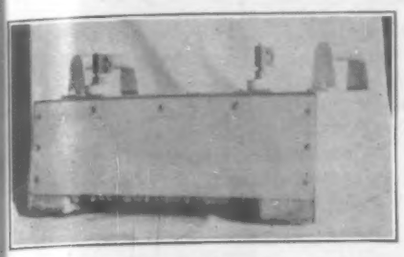
"Lincontrol" is offered as optional equipment with the new Lincoln Shield-Arc Welders, or it may be purchased separately and installed on motor-driven, belt-driven or gasoline-engine welders now in use.

Electric Heater Units for Local Stress-Relieving

For stress-relieving welds by the local application of controlled heat, attention is being called by H. O. Swoboda, Inc., 4301 Main St., Pittsburgh, Pa., to the new "Falcon" stress-relieving units, which are made in various sizes, shapes and capacities for assembly in such form as to fit the work. The 24-in. unit has a heating surface 16x24 in. in area and a capacity of 14 kw.

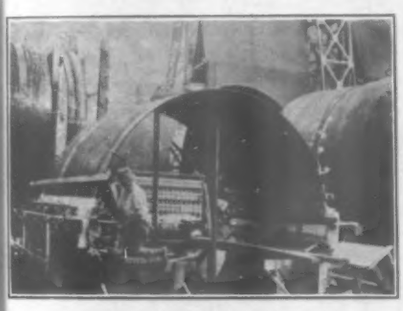
Stress-relieving the longitudinal welded seams in a 14-ft.-diameter pipe

made of 1-in. sheet, is shown in one of the illustrations. The units shown have a heating face 16 in. wide. A wound resistance heating element capable of operating at 1900° F. is inserted in a refractory front piece so designed as to give a distribution of heat across the 16-in. width as will compensate for the excess heat losses at the cool edges and produce an even temperature in the material across the full 16-in. section. The



"Falcon" Stress-Relieving Unit.

heating element is backed by approximately 5 in. of the best block-type heat insulation and the whole is securely built into a sheet-metal case. Thus a rugged unit is obtained, and handles are provided on the back for convenience in handling. The two sides of the heater have a 4-in. thickness of insulation, which is faced with stainless steel. The heating elements may be supplied for



Stress-Relieving the Longitudinal Welds in a 14-Ft.-Diameter Pipe.

any desired voltage. The terminals are brought out the back for ready connection to the source of energy.

These elements are designed to stress-relieve the seam in accordance with the A. S. M. E. Unfired Pressure Vessel Code requirements. That is, for a distance of six times the plate thickness on each side of the seam, the plate is brought up to 1100°-1200° F. at a heating rate of one hour for each inch of thickness, and the temperature is maintained at this value for the soaking period of one hour, after which the material is permitted to cool.

Operating figures for stress-relieving a 10-ft. length of welded seam in a 1-in. plate, as illustrated, show that five such units are required. These have a demand of 70 kw., which load is applied approximately 80% of the time during the hour to bring the temperature of the metal up to 1100°-1200° F. During the soaking period, the heaters are on 33% of the time to supply the radiation losses. The energy consumption, therefore, totals 87 kw.-hr.

The temperature of the material is checked by peening thermocouples into the surface at the points desired, and the heat application is controlled either manually or automatically.

New Pantograph-Type Gas Cutting Machines

Two new units, designated as the Airco-DB No. 7 Oxygraph and the Airco-DB No. 1 Travograph, respectively, greatly enlarge the range and scope of the line of pantograph-type gas cutting machines made by the Air Reduction Sales Co., 60 East 42nd St., New York, N. Y. The basic principle of operation of both machines is the same as that of the Airco-DB No. 6 Oxygraph.

However, the No. 7 Oxygraph employs a different pantograph construction, the fourth side of the parallelogram being removed to the rear. This arrangement allows the working ends of the arms to swing between the vertical posts which support the pantograph assembly, as well as in back of them, and permits the covering of a maximum cutting area with a given length of arms. This machine has no tracing bar. The tracing table for holding the full-scale drawing is part of the machine and is located on top of the bed between the vertical posts. Either a manually controlled or a magnetic tracer can be used.

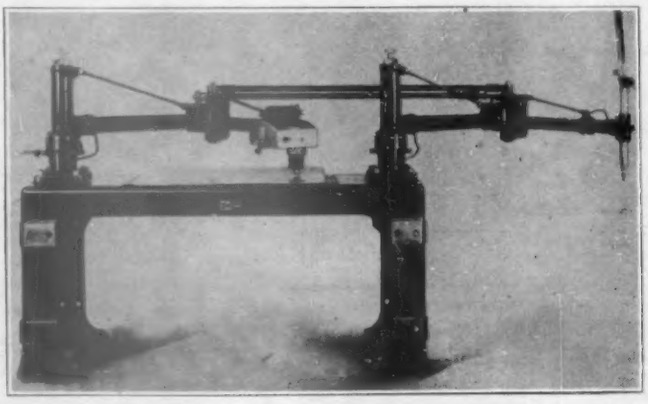
In the case of the No. 1 Travograph, the pantograph assembly is mounted on a carrier that travels on rails. This feature accounts for its greatly extended cutting area as compared with the No. 6 Oxygraph, in which the pantograph assembly is mounted on a heavy stationary base. Similar to the No. 6 Oxygraph, the No. 1 Travograph is fitted with a long tracer bar, attached to the outer ends of the pantograph arms. The tracer mechanism and cutting torch holders are mounted on this bar and may be moved to any position along the bar and secured in place by set screws. As many as six cutting torches may be mounted on the bar, these cutting a faithful reproduction of the path of the tracer. Either a manually controlled or a magnetic tracer may be used.

In operating the No. 1 Travograph, the pantograph assembly is swung by hand to bring the tracer wheel and torch to the starting point of the cut, the tracer lowered until its full weight rests on the table, the torch adjusted to the proper height above the work, and the driving motor started. The operator then guides the tracer along the lines of the drawing until the cut is completed.

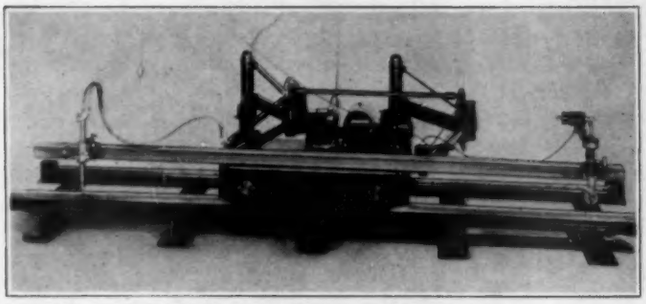
Automatic control of the carrier driving motor by the movement of the pantograph arms is a feature of this machine. As these arms reach certain limiting positions in their swing in either direction, they operate switches which actuate the magnetic reversing starter of the carrier motor. In this way the carrier is automatically positioned to the most advantageous location at all times. The position of the tracing device, its speed and direction of travel automatically control the direction and extent of travel of the carrier.

The pantograph assembly on both the No. 7 Oxygraph and the No. 1 Travograph have arms of rugged proportions, adequately braced for maximum strength and rigidity under load. Hinge fittings likewise are amply proportioned. All bearing surfaces are of large area and accurately machined. The bearings which mount the assembly at the vertical posts, and all hinged joints, are equipped with large-diameter ball bearings, designed for both thrust and radial loads. This assures smooth, almost frictionless operation.

The No. 1 Travograph carrier is also precision built and has large wheels with ball-bearing axles for smooth, easy running. The electric circuit provides for giving the carrier driving motor a slow starting speed and smooth pick-up, thus eliminating any jarring of the tracer bar. At each end of the carrier base a limit switch opens the carrier motor circuit and brings the carrier to a gentle stop. The carrier drive can be disengaged by a clutch, which permits quick positioning of the carrier along the track. The car-



The Pantograph Construction of the New No. 7 Oxygraph Allows Covering a Large Cutting Area.



The Rectangular Cutting Area of the Travograph Is 11 Ft. Long or Can Be Made Any Length By Additional Rail Sections.

rier is adequately counter-weighted to offset the leverage of the pantograph with arms fully extended, and safety hooks preclude any possibility of accidental tipping.

The cutting area or range of the No. 7 Oxygraph is a 30-in. square or a 36-in.-diameter circle, while that of the No. 1 Travograph is a rectangle 4½ ft. in width and 11 ft. in length with one 16-ft. section, or any length desired with additional rail sections.

Trade Literature

Seamless steel fittings for pipe welding are shown and described in a new 64-page catalog, published by the Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill. Dimensions, weights and prices are given for the full line of the company's welding fittings, including a new line of "Weldells" with socket ends. The flexibility of welded piping design is dealt with at much length, design charts are given, and solutions are worked out for nine typical problems of design.

Many interesting applications of metal spraying are illustrated and described in Bulletin 351, recently issued by the Metal Spray Co., 113 Llewellyn St., Los Angeles, Calif. These include the building up of engine pistons, compressor and pump cylinders, bronze ship propellers, rotor hubs and shafts of turbines, pump casings and impellers, lighting standards, mixing tanks, stills, hatch covers on board ship, galvanized pipe, natural-gas holders, and other equipment.

Their manual of arc welding was recently reprinted by Hobart Bros. in a new (fourth) edition, which covers welding equipment, design of joints, types of welds, procedure with the metallic and the carbon arc, welding of ferrous and non-ferrous metals, and costs. Various types of applications are shown, and an index is included. A copy may be obtained by addressing Hobart Bros., Box U-44, Troy, Ohio.

The design of welded joints for arc-welded tier buildings is being covered in a series of "Studies in Structural Arc Welding," issued by The Lincoln Electric Co., Cleveland, Ohio. Plate 44, which is the latest of this series, deals with fixed end connections of beams to columns to resist lateral forces. Connection schemes are clearly shown and examples of weld calculations are given.

The "A.E.F." line of spot welders is listed and specifications given in Bulletin 17, issued by the American Electric Fusion Corp., 2610 Diversey Ave., Chicago, Ill.

"Lukens Nickel-Clad Steel in the Process Industries" is the title of a new booklet issued by the Lukens Steel Co., Coatesville, Pa. Descriptions are given of finishes, and a table lists dimensions of standard plates. Many interesting welded plate applications are shown.

The application of tubes to problems of design is considered in Application Sheet No. 37, Series 2, recently issued by The Lincoln Electric Co., Dept. 237, Cleveland, Ohio. Comparisons are made between tubes and H-beams having the same weight per linear foot, and between tubes and H-beams having the same maximum moment of inertia.

"Torchweld" welding and cutting equipment is listed and described in catalog No. 34, which is a new pocket-size, 32-page publication replacing the "Blue and Gold" catalog, says an announcement from the Torchweld Equipment Co., 1035 W. Lake St., Chicago, Ill.

"Simplified Arc Welding" is the title of a 40-page booklet describing "Hobart" arc welders and accessories, and illustrating many interesting applications of the arc welding process. The booklet is issued by The Hobart Bros. Co., Box U-44, Troy, Ohio.

"Smart Bars" is the title of an attractive bulletin illustrating the use of monel metal in unique as well as conventional bar design. Copies may be obtained from The International Nickel Co., 67 Wall St., New York, N. Y.

Commercial News

Large Firms to Exhibit Again at World's Fair

The General Electric Co., Union Carbide & Carbon Corp., and Westinghouse Electric & Manufacturing Co. will again exhibit at A Century of Progress Exposition in Chicago this summer, each firm occupying the identical space used in last year's Fair, but with some changes and additions in exhibits and demonstrations. The General Electric's famous "House of Magic" will be retained, and the Union Carbide demonstrations on welding and liquid air will be given again this year on a continuous schedule.

Grand Rapids to Have Welding Show

Michigan Gases, Inc., formerly the Grand Rapids Welding Supply Co., Grand Rapids, Mich., are making plans for the holding of a welding show in Grand Rapids on May 24th to 26th. The change in name of this company, recently announced in *The Welding Engineer*, came about as a result of the great expansion of the company's business in recent years, so the old name was no longer representative of the company's activities.

Holds Successful 4-Day "Confab"

The 4-day "welding confab" held in St. Paul, Minn., March 14th to 17th, drew a registration of 1447. The Commercial Gas Co., of Minneapolis, sponsors of the "confab," spared no effort or expense to make the affair interesting and of practical benefit to the many visitors, who came from hundreds of miles around.

Particular attention was given to the comfort and convenience of visitors. Many arc welding units on demonstration were in almost constant operation, but all welding was done inside canvas booths to protect the eyes of those about. When

At the "Welding Confab" in St. Paul, a Wide Variety of Welding and Cutting Equipment Was Exhibited and Demonstrated.

one wished to enter a booth to see the welding being done, he was provided with a wooden face shield, 10x12 in. in size, at no expense. Likewise, welding spectacles were available for viewing oxyacetylene welding.

Since the demonstrators were limited to representatives of manufacturers whose equipment or supplies are handled by the Commercial Gas Co., there was no apparent rivalry between the exhibitors, they gave information freely, and those who desired to purchase equipment or supplies could do so at a booth located in the center of the exhibit hall. On every hand, there was evidence of close cooperation among the exhibitors and of consideration for the visitors.

In another section of the exhibit hall, castings offering serious contraction and expansion problems were actually preheated with charcoal and welded so those interested could gain knowledge of this phase of repair welding.

The demonstrations also included the soldering of aluminum, hard-surfacing, reclaiming plow shares, metal spraying, gas cutting, the welding of white metal, aluminum, copper, stainless steel, cast iron, and low-carbon steel; and welding by the oxyacetylene flame, the metallic arc, the carbon arc, and automatic arc welding.

Welding Takes to the Air in England

A series of radio broadcasts by the British Industrial Gases, Ltd., London, England, has been so successful that this firm has contracted for another series, according to word from The Harris Calorific Co., Cleveland, Ohio, licensers to the British concern.

Two broadcasts were conducted each week, on Saturdays and Sundays, for a period of 13 weeks, from Radio Normandy, located across the channel in France. Each program was of 30 minutes' duration and consisted of popular music interspersed with short announcements of the company's products and services. One announcement covered a manual on oxyacetylene welding and cutting at a price of 1/6d., and the response was enormous. A typical announcement used in this series of programs is as follows:

"Oxygen is the essence of life upon which all living creatures are dependent. In the industrial world, oxygen likewise serves an essential purpose for oxyacetylene welding. In addition to their numerous existing factories, depots and sales office, British Industrial Gases, Limited, are now constructing a large oxygen factory at Birmingham, whereby the well-known B.I.G. Welders Service, comprising the supply of oxygen, dissolved acetylene, carbide and apparatus at competitive prices, with free demonstrations and tuition by skilled operators, will be available in every important English industrial center. Please address your inquiries to British Industrial Gases, Limited, 34 Victoria Street, London, S.W.1."

Quasi-Arc Appoints National Distributors

Quasi-Arc Incorporated announces that the Keasbey & Mattison Co., Ambler, Pa., have been made sole distributors for "Quasi-Arc" electrodes and welding equipment, and that electrode stocks will be maintained in the principal cities throughout the United States. The Keasbey & Mattison Co. and the Ambler Asbestos Shingle & Sheathing Co., also of Ambler, Pa., have been brought under the same controlling interests as Quasi-Arc Incorporated.

W. A. E. Millinger, for many years connected with the engineering department of the Shell Oil Co., has resigned from the San Francisco staff of that company and is returning to Los Angeles where he will engage in general engineering practice. Mr. Millinger has had extended experience in welding supervisory work in the petroleum industry, following upon general design and manufacturing experience in production plants. He returned some time ago from an extended period of service for the Shell Oil Co. in China and elsewhere in the Orient and Malaya.

Promotions announced recently by Joseph T. Ryerson & Son, Inc., include the appointment of Harvey Dieterich as assistant vice-president in charge of the operations of the Structural and Special Order Departments in Chicago, and of Ainslie Y. Sawyer as assistant general manager of sales. Before their new appointments were made, Mr. Dieterich was manager of the Structural Department and Mr. Sawyer was connected with the Cold Finished Steel Division of the company.

W. Scott Milne has been appointed production manager of the Chicago plant of The Ingersoll Steel & Disc Co., which is a division of the Borg Warner Corp. Mr. Milne has served as general superintendent of the Quebec plant of Fairbanks, Morse & Co., as superintendent of the Massey-Harris Co.'s Toronto plant, and more recently as factory manager of the Batavia (N. Y.) works of the Massey-Harris Co.

R. H. Binns, Jr., and S. H. Wilson have become assistant general sales managers of Revere Copper and Brass Incorporated, and will have their headquarters in the New York Central Building, New York City, according to an announcement by C. D. Dallas, president of the firm. Mr. Binns will devote his time principally to merchandise sales, and Mr. Wilson will specialize on sales to industrial consumers.

Maxfield Pease, 4614 Prospect Ave., Cleveland, Ohio, has been appointed as exclusive sales representative in northern Ohio for the lines of "Falcon" heating equipment, including electric heat-treating furnaces, stress-relieving units for local application to welded seams, bare electric immersion heaters, and other equipments for specialized applications. Mr. Pease succeeds the late E. H. Merrick.

The Linde Air Products Co. held a welding clinic at the Minneapolis Iron Store Co., Minneapolis, Minn., who are their jobbers, during the automobile show staged in that city from March 10th to 17th.

K. L. Hansen, designer of the P & H-Hansen welder, manufactured by the Harnischfeger Corp., gave a talk on "Electric Arc Welding," on April 7th,

before the students of the Greer College of Welding, Chicago, Ill. This is one of a series of talks being given before this school by men prominent in the welding field.

The Victor Welding Equipment Co., 844 Folsom St., San Francisco, Calif., have been appointed Pacific Coast distributors by the York Engineering & Supply Co., 1583 Clybourn Ave., Chicago, Ill., for their line of radiator, tinning and welding compounds, including their "77" flux for brazing cast iron.

John Muir, of Quasi-Arc Incorporated, recently gave the students enrolled at The Cleveland School of Welding, Inc., Cleveland, Ohio, a highly interesting talk, in which he discussed the applications of welding in the oil industry and described some interesting uses of the process by English firms.

William F. Sailer, formerly with Alco Products, Inc., and The Griscom-Russell Co., has made connections with Steel and Tubes, Inc. He will be located in their Brooklyn office and will concentrate his efforts on the oil refinery and marine fields.

The Barde Steel Co. and the Doran Co., both of Seattle, Wash., are newly appointed distributors of "Enduro" stainless steel, produced by the Central Alloy Division of the Republic Steel Corp., Massillon, Ohio.

The Security Welding Co., Minneapolis, Minn., have added the Shelby Seamless Steel Tubing line for resale. The sizes carried in stock range from ¼ to 4 in. outside diameter and include almost all wall thicknesses.

The Gate City Iron Works, Omaha, Nebr., have been appointed as distributors of Toncan Copper Molybdenum Iron, it is announced by N. J. Clarke, vice-president in charge of sales, Republic Steel Corp.

The Hercules Motors Corp., Canton, Ohio, have established headquarters in San Francisco, Calif., in charge of Oliver S. Kelly, who will take care of the many interests of the company in the Pacific Coast section.

The Torch-Arc Welding Co., 16916 Detroit Ave., Lakewood, Ohio, has been appointed distributor of fluxes manufactured by the Pratt-Brayman Co., Bedford, Ohio.

E. L. Work, secretary-treasurer of The Ideal Face Shield Co., Columbus, Ohio, recently contracted a serious illness from which he died on March 12th.

Notes From the Field

Obtains Contracts for Lead-Lined Welded Tanks

A considerable business in the manufacture of lead-lined tanks has been developed by Mr. Blixt, of the Blixt Welding Works, Syracuse, N. Y. Such tanks are used by chromium-plating establishments. In the past six months, the Blixt shop has made 10 tanks, approximately 6 ft. square, and 20 larger tanks, ranging up in size to 18 ft., all lead lined with seams electric welded. Mr. Blixt recently secured a contract from two large typewriter manufacturers to build 15 similar tanks.

This concern has developed in a short time from a one-man job shop with one welding transformer to a concern employing four welders with three gasoline-driven portable welding units and two motor-generator sets, as well as a spot welder.

The American Concrete & Steel Pipe Co., of Southgate, Calif., has just completed the welding of 63 steel rings, 12 ft. in diameter, which are to be used to link together the 40-ton sections of concrete pipe to form what is known as the Little Morongo section of the Colorado River Aqueduct, near Indio, Calif. These metal cylinders, which are all-welded by the electric arc, are placed in the center of the walls of the concrete pipe and act as reinforcing for the thick concrete—a comparatively new process which is meeting with marked success in the field.

The Atlas Scraper & Engineering Co., of Bell, Calif., is successor to Givan & Ogle Iron Works, at 6203 Maywood Ave. H. L. Givan, C. B. Ogle and G. A. Lathrop are jointly interested in the new concern, which will specialize in structural-steel welding and the manufacture of the "Atlas" line of scrapers, graders and other highway equipment, all of which are all-welded products.

C. W. Chase, proprietor of the Marine Welding Works, 223 East 1st St., San Pedro, Calif., contemplates the early installation of a lathe, drill press and large grinder for facilitating the handling of more varied and difficult jobs, and to expand the scope of his shop service. He recently added a 300-ampere Lincoln portable welding unit.

Parrish Bros., Azusa, Calif., recently completed a large contract with the Macco-Lewis Construction Co., of Clearwater, Calif., on the San Gabriel No. 2 dam near Monrovia. They recently built a portable electric welding unit from a 400-ampere Lincoln generator driven by a Dodge "6" motor and mounted on an International truck.

Reseck & Myers recently opened a general machine and welding shop at 5003 Alhambra Ave., East Los Angeles, Calif. They will do a general line of welding, but will specialize on steam-shovel repair work. Mr. Reseck formerly was associated with L. N. Railsback, local distributor for the Bay City Shovel Co.

Recently while handling a heavy casting preparatory to welding it, "Art" Johnson, of the National Electric Welding Corp., Huntington Park, Calif., had the misfortune of breaking a leg. The break is just above the ankle, and will give "Art" an excuse for taking it a little easier for a time.

Welding will be used extensively in the manufacture and installation of refrigerating machinery for an addition to the lemon packing plant of the San Dimas (Calif.) Lemon Assn. The contract for this work was recently awarded to the York Ice Machine Corp., of Los Angeles.

The Boyle Avenue Welding Works, 1313 Boyle Ave., Los Angeles, Calif., recently opened under the management of S. A. Wood. Mr. Wood recently came to Los Angeles from Lansing, Mich., where he operated a shop for a number of years.

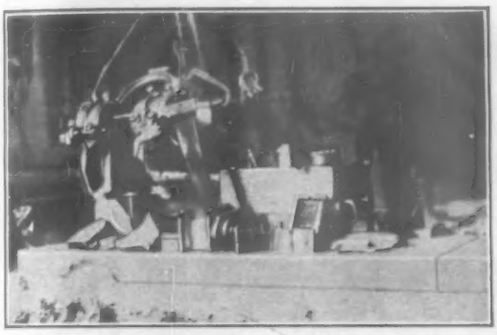
John E. Belmer, proprietor of the Dubuque Welding & Body Works, Dubuque, Iowa, recently had U. S. Government Patent No. 1941651 issued him, covering a new type of fluid compressor for use in the refrigeration, air, gas and liquid fields.

Mitchum & Schaefer, Inc., Indianapolis, Ind., recently delivered three cooling tanks to the U. S. Tire Co., at Indianapolis. These tanks weighed 1500 lb. each and were constructed of 10-gage hot-rolled sheets are welded with "Fleetweld."

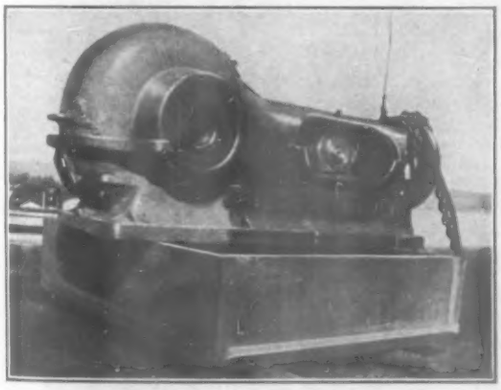
A new building is being erected at 171 Paramount Blvd., in Hynes, Calif., to replace the welding shop recently destroyed by an explosion and fire. F. L. Henry, who formerly operated the shop at this location, will carry on as usual.

"Val's" Welding Works, 2609 Cherry Ave., Signal Hill, Calif., recently opened

Broken into 65 pieces... repair-welded *without preheating* with TOBIN BRONZE



These "before and after" illustrations tell their own story. The blurred photo shows the broken parts; the other shows the repaired air compressor after repair-welding with Tobin Bronze.



There is a suitable Anaconda Filler Rod for every bronze-welding purpose. Principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze*	1625°F	Electrolytic Copper	1981°F
Manganese Bronze	1598°F	Silicon Copper	1981°F
Brazing Metal	1706°F	Phosphor Bronze	1922°F
Everdur*	1866°F		

for arc welding

Silicon Copper	1981°F	Phosphor Bronze	1922°F
Everdur*	1866°F		

*Reg. U. S. Pat. Off.

IMAGINE this situation . . . a 6,000 lb. air compressor, owned by a gold mining company, shattered into 65 fragments by actual count. A new compressor would cost $3,000 . . . not to mention lost time.

An experienced bronze welder examined the broken base plate, and the shattered hood . . . instantly realized that only a low temperature rod, which would eliminate preheating, could be used. He quite naturally selected Tobin Bronze.

The pieces were joined together in sections, and each section was allowed to shrink before being "assembled". Actual time of welder and helper was only fifteen hours.

Tobin Bronze was selected for this particular job because of its uniformly high quality . . . and its dependability . . . which also explains its popularity with thousands of experienced welders who will use no other brand. One of a line of seven Anaconda Copper Alloy Rods, Tobin Bronze enjoys wide-spread acceptance as the *ideal rod* for the general oxy-acetylene welding of cast and malleable iron.

All seven Anaconda Welding Rods are available through leading distributors . . . usually shipped in bulk, but also obtainable in clearly labeled ten-pound packages. Publication B-13, mailed on request.

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities

In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

ANACONDA WELDING RODS

for business under the management of G. F. Valentine. The shop at this location was formerly operated under the name of the Signal Iron Works.

The Richfield Oil Co. have consolidated the welding shops of their production and pipeline departments into one shop, which is located in the company's field camp at Signal Hill, Calif.

The city of Knoxville, Iowa, recently installed a Harris "Red Head" acetylene-generating unit complete with torches, purchased through The Balbach Co., Omaha, Nebr.

The shop of the Superior Welding & Brazing Co., Russell and Grand Blvd., Detroit, Mich., was recently entered at night and five welding torches and one cutting torch stolen.

W. A. Masters, of Long Beach, Calif., has opened an oil-field service welding shop at Nevada and Orange Aves., on the south side of the Signal Hill oil field.

A welding shop will be included in a group of other shop buildings which will be erected in the near future by the Union High School, of Turlock, Calif.

The AAA Welding Service, Chicago, Ill., have purchased a "Sight Feed" acetylene-generating unit for use on a pipeline construction job.

The Lincoln Oil Refinery Co., Robinson, Ill., recently installed two "Metallizing" outfits for spraying metal onto surfaces to resist corrosion.

Frank Fitzharris, formerly with the Wm. Yates Machine & Welding Shop in St. Louis, Mich., has opened a gas and electric welding shop in that town.

The Slaymaker Electric Welding Co. of Detroit, Mich., has moved from 68 W. Grand Blvd. to a more desirable location at 4517 Michigan Ave.

Clyde Thurman, formerly with Posey & Son, of Summerton, Ariz., recently opened a welding shop at 2nd and Maiden Lane, in Yuma.

The Fort Dodge Top & Body Co., Fort Dodge, Iowa, have installed a Harris "Red Head" acetylene-generating outfit complete.

· CLASSIFIED ADS ·

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines
Count 8 words to line. Add 6 words for keyed address.

FOR SALE

A BARGAIN

300-lb. Davis-Bournonville Acetylene Generator, used only three months, for sale at one-third its cost. C. H. Dockson Co., 2885 E. Grand Blvd., Detroit, Mich.

Bargains—Demonstrator Arc Welders. Gasoline, electric drive, belted, or coupled-together outfits. 30 days' trial. Easy terms, if desired. Write Ken's Welding Exchange, Box U-441, Troy, Ohio.

For Sale—Two-man welding shop fully equipped for acetylene and electric welding. Doing excellent business. A-1 location in eastern central Ohio. Reason for selling: leaving town. Address MR-3, The Welding Engineer.

Bargains—Guaranteed used acetylene and welding outfits, complete air compressors, battery chargers, grease guns, paint sprayers, jacks, tire machines, electric drills, buffers, etc. Friedman Equipment Co., Inc., 3117 W. Roosevelt Road, Chicago, Ill.

HELP WANTED

Estimator Wanted—Experienced on tank and plate work for oil, chemical, and food industries, using steel, aluminum, and stainless steel. Experience on barges and structural steel desirable, but not necessary. Write full experience and why you believe you could serve us. St. Louis Structural Steel Co., P. O. Box 230, East St. Louis, Illinois.

Responsible Dealers Wanted

Valuable territories are open to substantial, live-wire dealers. Particulars, including attractive discounts, explained upon request.

SMITH-WATERS WELDER

Competitive tests show that the Smith-Waters Welders can save as much as 50% in operating costs. The stable arc assures constant deposition of weld metal, and sound welds. No moving parts. Two-year guarantee.

Write for descriptive material.

David H. Smith & Sons, Inc.
5111 Second Ave.,
Brooklyn, N. Y.

POSITIONS WANTED

Welder and General Repairman—Experienced with electric arc and torch on wide variety of work. Have U. S. Government references as boilermaker and inspector. Recently employed by public utility. J. H. Seymour, care of Wayne Hotel, St. Petersburg, Fla.

Combination Welder—16 years' experience, including refrigeration piping, stainless steel, bronze, factory production work, and architectural aluminum work. Will work as welder or take charge of shop. Will go anywhere. References. E. A. Johnson, 1024 N. Lawler Ave., Chicago, Ill.

Welder—Desires change. Handles speedy flat work (platforms, partitions, frames etc.) with great skill, does all shop work, prepares and sets up, creates jigs and forms to assure speedy production. Organizes and supervises. Produces above average if aided by proper designing. Desires connection with progressive manufacturer in New York or Philadelphia area. Address AP-1, The Welding Engineer.

Engineer and Coordinator—Somewhere there is a concern in need of a man to coordinate all their welding problems and welding activities, from the drafting room to the shop—not just an expert operator, accountant or metallurgist, but a man with experience and background along all these lines—a man who is thoroughly versed in welded design and welding equipment, based on 10 years' practical experience, and who can obtain the cooperation of all concerned, including the operators. A man is available who can effect economies in such an organization. He is a graduate engineer. His references are of the highest character. If interested, address AP-2, The Welding Engineer.

REWARD

$50.00 reward for information leading to the location of Ira Scott, formerly of Worland, Wyo., who purchased a Dusarc gas engine set and disappeared with it on a Hupmobile truck, if such information leads to recovery of the machine. $35.00 reward if the information is so handled that we subsequently recover the machine. $25.00 reward for information as to where Ira Scott is, whether or not we can obtain the machine. C. J. Holslag, Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J.